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THE VOYAGE SOUTHWARD OF THE "DISCOVERY."*

I. LONDON TO MADEIRA.

By HUGH ROBERT MILL, D.Sc., LL.D., Sec. R. Met. Soc.

I HAVE been privileged to take only a small part in the preparations for the *Discovery* expedition, and the report of my work requires few words, even if a brief account of the voyage as far as Madeira is included.

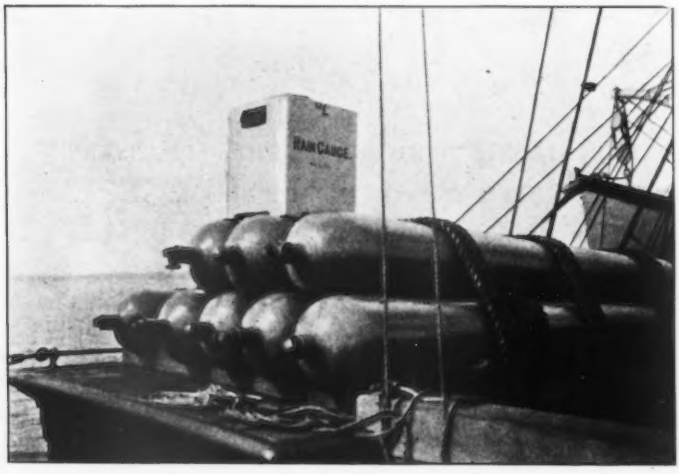
On July 27, 1901, I was asked by Captain Scott and Mr. George Murray to accompany the *Discovery* on the first short stage of her voyage, in order to instruct the observers on board in the methods of oceanographical work. From having been a member of the meteorology sub-committee, I was already aware of the plans so far as the investigation of atmospheric conditions was concerned. After acquainting myself with the apparatus and material which had been provided for the study of the sea, I joined the *Discovery* in Stokes bay on August 3, she having left the Thames on July 31.

The time before sailing was fully occupied in the completion and adjustment of some of the apparatus, and seeing to the stowing of all the instruments and chemicals in the physical laboratory, so that they should not be endangered by the rolling of the ship.

On August 5 the *Discovery* moved across the Solent and anchored off Cowes. Sir Clements Markham, Mr. Longstaff, Sir Leopold McClintock, Sir Allen Young, Admiral A. H. Markham, and Mrs. Scott were on board, and at 11.30 a.m. their Majesties the King and Queen and H.R.H. Princess Victoria paid a private visit of inspection. The genuine interest

* Papers read at the Royal Geographical Society, February 24, 1902.

which the royal party took in the ship and in every department of the scientific work was most gratifying and stimulating to every one on board. They not only visited every part of the vessel, but inquired the use of each piece of apparatus shown to them, and watched its working with the keenest attention. The Queen was particularly attracted by Forel's xanthometer (an instrument for measuring the colour of the sea by comparison with a graduated series of solutions ranging from pure blue to yellowish-green), and, after seeing how it was used, herself explained the method to the King. The presentation of signed portraits to the wardroom mess, and of the Royal Victorian Order to Captain Scott as a mark of the King's confidence in him, gave



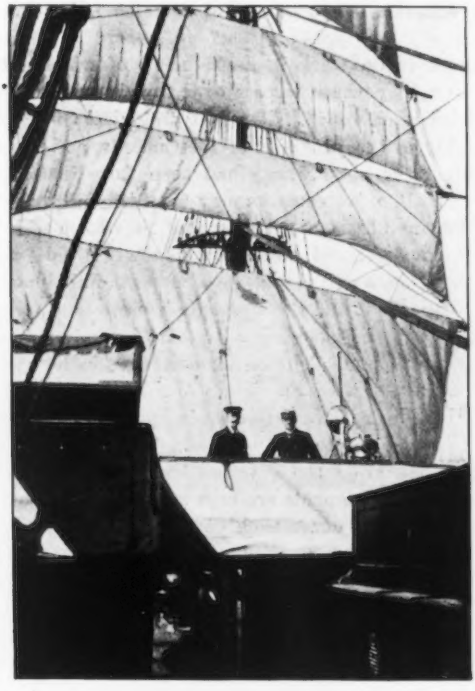
RAIN-GAUGE, PLACED ON THE HYDROGEN CYLINDERS ON THE PORT QUARTER OF THE *DISCOVERY*.

pleasure to all, and the friendly cordiality which characterized the King's brief speech of farewell to the ship's company will be a heartening memory in many a dreary hour of antarctic winter.

On August 6 the *Discovery* weighed anchor at noon, and proceeded down channel under steam in the teeth of half a gale of wind, stopping off Yarmouth, in the Isle of Wight, to land the last of the friends who had accompanied the explorers so far. Eight days were occupied in making the passage to Madeira. The weather was fine, although the sky was rarely altogether free from cloud, and there was only one night on which the sunset was sufficiently clear to show the interesting phenomenon of the green ray. This was on Sunday, August 11, when, as the upper edge of the sun touched the sea-horizon, a beam of yellow light, almost instantaneously passing through green to blue and dying

away in violet, was distinctly visible. It is remarkable that so few observers have noticed this very striking appearance, which must be visible every time the unclouded sun dips beneath a sharp horizon.

The *Discovery* arrived off Funchal, in Madeira, at 2 a.m. on August 15, and, after some slight repairs to the rigging, she started on the evening of the following day. A small tug towed the ship 4 miles out into the full strength of the trade-wind, and at 6.30 p.m. she was cast off, proceeding for the first time under sail unaided by



MAINMAST UNDER FULL SAIL.

steam. Half an hour later, just as the sun was setting on Friday, August 16, I took the last photograph of the departing vessel, and turned back to Madeira with many regrets.

So far as my limited experience went, the *Discovery* proved a particularly comfortable ship, for her rolling was remarkably easy compared with that of most steamers of her size. The officers and scientific staff shook down to their work at once, and the greatest harmony and good humour prevailed in the wardroom, and indeed

throughout the ship. I was never in pleasanter company, nor among men more honestly bent on doing their very best to make the most of the splendid opportunity presented to them. The essentially scientific turn of Captain Scott's mind impressed me strongly, and the rapidity with which he mastered the details of oceanographical and meteorological work was remarkable. His quiet firmness and tact in a difficult and unusually responsible command are equally striking. For the routine observations now most urgently required, I feel sure that the organization of the British Antarctic Expedition is not inferior to that of our German colleagues on the *Gauss*, or our Swedish fellow-workers on the *Antarctic*.

With regard to the work in departments of which I have special knowledge, I ought perhaps to pass over that in meteorology, as I had little to do with it on board. The Meteorological Office had done its work thoroughly in the provision of instruments, and the officers who were to conduct the observations had been fully instructed at Kew Observatory. Still, a few remarks may be of interest.

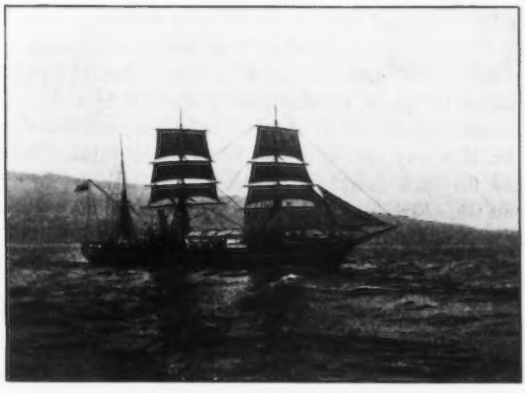
For the routine observations, a form of Stevenson screen is erected on the wall of the botanical laboratory on the port side, and when the ship is under way there will always be a current of air blowing through the gangway between it and the magnetic house. The screen contains a wet and dry bulb thermometer, a mercurial maximum, and a Sixe's maximum and minimum. The barometer, on the Kew pattern, was in the magnetic house, with its cistern about 12 feet above the water-line (though I believe it was afterwards moved), and a barograph is kept at work in one of the companions. A thermograph and a hair hygrograph are placed on the outer walls of the magnetic house, and the three recording instruments are kept running to Greenwich time, a mark being made on the curve each day at local noon, so that a local time-scale may be afterwards applied. As the ship's time will be changed daily by amounts varying from a few minutes up to perhaps an hour or more, it would of course be impossible to adjust the recording instruments to follow it. The temperature readings are checked by means of an Assmann's Aspiration Psychrometer, and sling thermometers are also provided for comparison. Rainfall observations are made by means of a marine rain-gauge on Dr. Black's pattern, the placing of which was a matter of some difficulty, on account of the way in which any part of the vessel may be sheltered when she is under sail. The method finally adopted was to place the rain-gauge upon the cylinders containing gas for the balloon, on the top of the small deck house aft, on the weather side, shifting it whenever the ship changes her tack. The result will not be a perfect record, but it will be a fair test of the value of a rain-gauge at sea.

The surface temperature of the sea is taken each time the instruments on board are read, a small canvas bucket being used from the

bridge for the purpose of drawing a sample of water. Once daily, at noon, the colour of the sea-water is measured by means of Forel's colour-scale, or xanthometer. As this observation requires a keen colour-sense, it has been placed in charge of Dr. E. Wilson, the artist of the expedition.

The whole of the meteorological work on board is under the special charge of the first officer, Lieut. Charles Royds, R.N., who has had considerable experience in observing.

For reaching great elevations in the air, reliance is to be placed on kites, and for this purpose light aluminium meteorographs have been provided for attachment to the large box-kites of Hargrave's pattern. While in the Bay of Biscay, an experiment was made in flying a couple of small box-kites tandem-fashion from the ship, and they were found



THE *DISCOVERY* LEAVING MADEIRA.

to rise readily and maintain their altitude steadily for nearly an hour when the ship was running before the wind, and therefore in the least favourable condition for the experiment. No instruments were attached, and the only difficulty found was that the kites descended too abruptly.

It was interesting, on the voyage out, to see how, as the ship left the region of the variable westerly winds and entered that of the steady Trades, the barograph traces lost the irregular ups and downs characteristic of British weather, and settled into the uniform semi-diurnal wave of the tropics, each day reproducing the gently rising and falling curve of the day before.

The thermometers supplied for use on shore, or during the wintering, were graduated so as to be capable of showing temperatures lower than any that have yet been recorded in nature. For measuring wind-pressures, Mr. W. H. Dines supplied one of his pressure-tube

anemometers, with a special adjustment fitting it for use in extreme cold. A sunshine-recorder has also been designed which will admit of a continuous record when the sun remains above the horizon during the whole twenty-four hours.

Oceanographical research in the antarctic area is of particular importance, as all the evidence which is at present available points to the Southern ocean as the mainspring of the circulation of all the seas of the globe. It is desirable, therefore, to have observations connecting the temperate and tropical oceans with the Southern. This was attempted on the voyage of the *Discovery* by regular observations of the temperature and salinity of the surface water twice daily. The determinations of salinity on board a small vessel cannot possibly be made with the minute degree of exactness properly insisted on in a laboratory on shore; but they can be made with quite sufficient accuracy for the purpose of elucidating the physical condition and probable movements of the water. Two methods are employed—that of specific-gravity determinations by means of Buchanan's absolute hydrometer, and that of chlorine determinations by the use of a standard solution of silver nitrate. In this way two entirely independent values for the salinity are obtained for each sample. The physical laboratory in which these observations were carried on at first, is possessed of one great advantage for work in polar regions, for its proximity to the galley ensures that it is always warm; but in the tropics this was so little of a benefit that I understand the work was removed to one of the cabins. This laboratory also became inconveniently crowded with iron apparatus of all kinds, as it lies outside the non-magnetic area within which the zoological and botanical laboratories stand, and these are consequently not allowed to contain so much as a file or an iron wire bottle-brush.

Lieut. E. H. Shackleton undertook the salinity determinations, and proved a very apt and enthusiastic pupil. The record of his work from Madeira to Cape Town, which I have seen, bears every mark of care and accuracy. In the absence of a trained chemist, it seemed inexpedient to attempt the collection and analysis of the gases of sea-water, or determinations of alkalinity or ammonia. It may be mentioned that the distilled water required for the various solutions is provided on board, thanks to the care with which Mr. Skelton manages the distilling plant in the engine-room. The chemicals for standard solutions were weighed on shore, and each quantity separately sealed up in a glass tube. Mr. Ferrer, the geologist, had received instruction from Prof. Letts in the use of a special apparatus for determining the amount of carbonic acid in the atmosphere, which he fitted up in the physical laboratory; but the difficulties in the way of carrying out the work are very great. All chemical work at sea has to be performed under difficulties, and is only possible in a very carefully planned laboratory adapted structurally to the special work that is to be

undertaken, so as to ensure sufficient light and secure resting-places for every piece of apparatus, however small.

The appliances for deep-sea work, most of them supplied by the Admiralty, comprised an ample supply of Miller-Casella thermometers, a certain number of Negretti and Zambra's reversing thermometers in Magnaghi frames, and several Challenger-type water-bottles for collecting samples at various depths. Most reliance will, however, be placed on the Pettersson-Nansen insulating water-bottle, which secures a sample of water and enables the exact temperature to be taken simultaneously. Three of these beautiful pieces of apparatus have been supplied, and they are expected to yield most important information as to the distribution of temperature and salinity with depth. I have also sent out a water-bottle on my own pattern for use in shallow water, for which it has certain special advantages.

Convenient cases for holding the thermometer and water-bottles, to be fixed on the after wall of the wardroom companion, were designed on board and made by the ship's carpenter, so that the instruments could be kept safely and conveniently on deck ready for use. Lieut. M. Barne takes charge of the deep-sea apparatus.

The Lucas sounding-machines of large and small size appear to be very well suited for their work; but the steam-gear for working the wire lines had not been fully tested while I was on board.

In this brief sketch reference has only been made to the parts of the work which came under my personal notice, or as to which I gave written instructions to supplement those contained in the 'Antarctic Manual.' I have said nothing as to the captive balloon, the platinum resistance thermometer, the whole magnetic equipment under Lieut. Armitage's charge, the physical apparatus to be used by Mr. Bernacchi, or about many branches of research which will be taken up if time and opportunity permit. And I have said nothing of the arrangements for biological work under the charge of my old friend Dr. Koettlitz and Mr. Hodgson. Over the arrangement of this department Mr. George Murray, the scientific director, personally presided, and I am indebted to him, as to all the officers and to every member of the scientific staff, for much kindness and the most hearty help in all my work on board.

II. FROM MADEIRA TO THE CAPE.

By GEORGE MURRAY, F.R.S.

THE first observation of general interest which I find in my scientific diary after leaving Madeira is under date August 22, obs. lat. 17° 22′ N., long. 20° 7½′ W. It is as follows: "The morning opened with every

visible sign of having been in the vicinity of a gale, and the meteorological observations coincided with these eye observations. . . . At noon there was a remarkable change in the appearance of the water, which I put down without hesitation to the presence of large shoals of diatoms. We started pumping (through tow-nets) at once, and the appearance of the net and the Murray-Blackman funnels confirmed this. So soon as it settled I made a brief examination, finding certainly many Peridinians (*Ceratium* and *Peridinium*), but, far outweighing these, an extraordinary quantity of broken-up organic refuse. Some of it

TRINIDAD ISLAND.

appears to have been digested and excreted by marine crustacea, etc., but most of it looks like decomposed matter from a river, broken-down fragments of vegetation too much decomposed for determination. There are large numbers of bacteria. I inquired our position, and we are about 120 miles off the African coast. The Senegal river is hardly equal to this. I am therefore driven to alternative explanations, viz. an offshore gale, as at present indicated by the meteorological observations, into the effect of which we have run, or an upwelling of inland waters, such as that recorded by Mr. Benest in these parts on the Silvertown Company's ship *Dacia*. The surface temperature is 81°;

the 8 a.m. temperature was 77°·5. Lieut. Shackleton gives the density at 15° 56′ C. = 1·02685, the salinity at 84° F. = 20·75." I commenced that evening a prolonged microscopic examination of this water, finishing at 2 a.m. next day. The result I note as follows: "Most of the organic *detritus* is unrecognizable, but with it now and then there are particles which indicate an origin from land waters. However, this is in small proportion, and it would be dangerous to conclude that this great body of matter had an exclusively land origin. There are more Peridinians in it than I at first thought. It appears that there is commonly here a large patch of greenish-yellowish water, and there is certainly a case for farther investigation, not only of the surface, but of the lower layers by water-bottle." Very soon after 8 a.m. on the next day (lat. 15° 25′ N., long. 20° 25′ W.) we noticed a distinct change in the colour of the sea, and by noon it had regained its normal blue to the casual eye. I append the readings by Dr. Wilson of Forel's xanthometer (adjusted previously by Dr. Mill).*

17 August, noon	...	...	...	...	5	per cent.	yellow
18	„	„	...	...	...	...	5	„	„
19	„	„	...	...	...	...	7	„	„
20	„	„	...	...	...	...	7	„	„
21	„	„	...	...	...	...	9	„	„
22	„	8 a.m.	...	...	...	...	9	„	„
22	„	noon	...	...	...	...	30	„	„
23	„	8 a.m.	...	...	...	...	50	„	„
23	„	noon	...	...	...	...	9	„	„
24	„	8 a.m.	...	...	...	...	5	„	„
25	„	8 a.m.	...	...	...	...	5	„	„
26	„	8 a.m.	...	...	..	...	5	„	„

Work was now getting reduced to a system, and general directions for all hands, naval and scientific, were drawn up and inscribed in the Order Book by Captain Scott and myself. The most splendid spirit declared itself. While Captain Scott occupied extemporized quarters in the port laboratory, engrossed with his new-found study of the microscope, in which he became miraculously expert almost at once, as did Lieut. Royds, I found myself interested more and more in affairs only verging on my province, and occasionally occupying positions our Commander kindly thought inconsistent with my duty as the parent of a family.

Not only was the general efficiency of the staff in progress, but we began to interest and educate the men in the work of the Expedition, and a weekly course of lectures was begun with lantern slides and microscopic demonstrations to heighten their interest. This

* On my homeward passage in the *Briton*, I found much closer in shore, at the same latitude, precisely similar conditions, and I wish to record these observations in the hope they may be followed up.

immediately had an excellent effect, and I found myself beset with later inquiries as to the meaning of this or that apparatus, or what was the place of some organism in the economy of sea-life, that were as gratifying as they were often puzzling. All this excellent good feeling was kept up without one single break in the "horse latitudes," where one day we collected fifteen tons of rain-water from the deck.

So soon as I observed that our projected course lay near the island of South Trinidad, I entertained the hope that we might be able to effect a landing on so interesting a spot. Its interest to the naturalist lies in the fact that it is an oceanic island of considerable elevation, and some hundreds of miles from the nearest land of any extent, and, but for abortive attempts to settle on it, was uninfluenced by man. Halley (astronomer-royal) landed on it April 17, 1700, and put on it some goats and hogs, and a pair of guinea-fowl from St. Helena. An English attempt to settle on it was made in 1781, and a like unsuccessful settlement was tried by the Brazilians * at a later date. Other recorded landings are by Amaso Delano (1803), Sir James Clark Ross (1839); and doubtless the island has been frequently visited for a few hours at a time by the crews of sailing and other ships. Our sailmaker told us of such landings, and Captain Scott found near our landing-place a record of a visit by H.M.S. *Ruby* in 1889. Most of the above particulars are taken from the 'South American Pilot,' part i. 4th edit. (1893), p. 43, which also records a visit by Captain Buckle in H.M.S. *Growler* in 1844, and from Mr. E. F. Knight's 'Cruise of the *Falcon*.' Mr. Knight spent some time on the island, and gives the only detailed account of it known to me (*loc. cit.*). I have read his 'Cruise of the *Alerte*' since my return.

The island is in lat. 20° 30′ S. long., 29° 22′ W. (approx.), is about 3 miles in length (north-west and south-east), and about 1¼ in breadth. It consists of a rugged mass of tumbled volcanic rock, the central peak rising, according to the 'South American Pilot,' to 3000 feet, and according to the Admiralty chart, 2020 feet. The Martin Vaz islets, about 26 miles distant from South Trinidad, are three small barren rocks which have no influence on the fauna and flora of South Trinidad. The picturesque account of Mr. Knight's adventures on the island is easily accessible and well known, and had no small influence on the more adventurous members of our party in whetting their appetite for a "run ashore" on it. The opportunity which it would afford of exercising the observing and collecting powers of our company was the main serious purposes of our landing, though the mere pleasure of the undertaking was shared by all alike, commander, officers, and men. It was easy to tell at a glance at the men who were appointed to land and who were not. One bluejacket is reported to have wept in vexation

* ? Portuguese.

at being left behind. There was a lingering fear, begotten of the navigator's chaff, that we might after all miss this minute oceanic islet in the night, and all hands were comforted by the bright and early intimation at 5 a.m. that land was 20 miles right ahead.

During the next few hours sketchers and photographers were busy, and Dr. Wilson's coloured drawings of the approach to the island render most accurately the dream-like appearance of this remarkable cluster of volcanic peaks in the early tropical dawn. To some of us the out-

COAST OF TRINIDAD ISLAND.

line suggested an early morning view of the old town of Edinburgh, culminating in the Castle Rock; others, perhaps more happily, thought of Arran from the north or north-east. A nearer approach showed our scenery to be wilder and more inhospitable—to be, in fact, the Trinidad of our impressions from Mr. Knight's narrative. But the business in hand began to claim attention.

At 10.30 a.m., according to plan, two whale-boats left the ship. The first, in charge of Captain Scott, contained Dr. Koettlitz, Mr. Hodgson, Mr. Skelton, and myself; the second, in charge of Lieut. Royds,

carried Lieut. Shackleton, Dr. Wilson, and Mr. Ferrar. The proposal was to land near Mr. Knight's cascade, at a rock which he describes as forming a natural pier. To judge by the surf along the coast, it was the only possible landing-place in sight, and, as we approached, it offered few attractions. By anchoring the boats and backing in, all landed without mishap, and our equipment was passed ashore. Two hands were left in each boat with fishing-lines, and I may mention they had excellent sport during our absence, securing forty-four *Balistes* and two small sharks. Forty-three of the *Balistes* were of the same species, and the remaining one was the only specimen of its kind obtained either by the boats or the shore party. The natural pier was not of coral, as Mr. Knight describes it, but of a volcanic rock, which was worn in places in such fashion as to suggest coral to a casual observer.

The shore party were Dr. Wilson, Mr. Hodgson, and Mr. Ferrar, with several hands. Another party, Captain Scott, Dr. Koettlitz, Lieut. Royds, and myself, with four men, ascended the ravine, reaching the tree-fern zone, the lower limit of which was 1090 by both aneroids. Mr. Skelton reached by himself an elevation at another place where he could see, across the island, the Martin Vaz islets on the horizon; and Lieut. Shackleton, also by himself, followed on our track as far as a plateau at the foot of the high waterfall where the stream emerges from the forest of tree-ferns. I shall take each party's story by itself.

Our party found very little of interest at first, the piled-up rocks being partly covered with a coarse *Cyperus*, and here and there in the crevices grew a fern. Another very wiry plant (*Fimbristylis*) appeared higher up, but sparsely, and at about 400 feet another fern. I scraped some fresh-water algæ from stones in the bed of the stream, which was low, though the banks show that at times it must be a deep torrent, here and there branching out into other channels now dry. Two lichens were fairly abundant on the stones and on the trunks of the numerous dead trees, described by Mr. Knight from this and other valleys. These trunks (*Cæsalpinia* sp.) have plainly been dead for many years, and are bleached white, and for a great part covered with lichens. The wood is a hard red wood, and, from the abundance of the trunks, they must represent a considerable forest, now vanished from the island. Dr. Koettlitz was busy all the way up collecting flies, spiders, dragonflies, etc., which were abundant considering the scarcity of vegetation. Mr. Knight appears to have observed no insects. We obtained a few earth-worms here and there, and I should say they were unexpectedly common. At the plateau at the foot of the high waterfall we turned to the right, and, ascending by a precipitous route, reached a ledge, along which we passed to the left to the tree ferns, and stopped in the bed of the stream where it issues from the tree-ferns to fall over the face of the precipice. Some way down the sheer face of this cliff, we observed the basaltic rock take a columnar form, not quite perpendicular, but emerging at an angle from

the rock face. On the way up I collected a sage without flower, which was the only phanerogam, besides the two *Cyperaceæ* and the dead trees, we met with. There was a fair amount of vegetation, but a perfectly amazing lack of variety. Considering the island's favourable situation from a climatic point of view, this barrenness is scarcely credible. Land-crabs simply swarmed all the way up, and I am bound to confess they did not make upon us the same weird impression that Mr. Knight

HEADLAND OF FRIABLE BLACK ROCK, TRINIDAD ISLAND.
(*From Sketch by Mr. Wilson.*)

experienced. Possibly we regarded them simply from a naturalist's point of view. Dr. Koettlitz and some of the men fed them at lunch-time, and of course we collected suitable specimens. Bird-life—especially petrels—was everywhere abundant. Birds hovered about our heads, and when we stopped, perched close beside us. They were quite easily taken by the hand, in butterfly-nets, etc.

On reaching the tree-ferns, I expected to find under their shelter a profusion of mosses, hepaticæ, lichens, etc., but even there the same

barren character was maintained. A few small ferns, fern prothallia, and some filamentous green growth, which may be the sporogonium of a moss or a small alga, were growing near the stream where it passed through the ferns. I cut down and brought with us a small tree-fern. The average height was from 12 to 15 feet, though I should say that a few were markedly higher.

My first impression was that the dead tree-trunks were the remains of a forest the trees of which had perished from some fungus or insect plague many years ago. They were very much in the condition Mr. Knight describes on the occasion of his visit twenty years ago. The wood is a very hard durable wood, and seemed to be very little invaded by fungus growth. Taken together with the general barrenness of the vegetation, I cannot escape the idea that some general destruction of vegetation has taken place in this valley, possibly over the whole island, and that its present condition represents a struggle back again to the normal state. There was no sign of the pigs and goats which at one time were landed on the island. One cannot help recalling the destruction of trees in St. Helena by goats as recorded by Mr. Darwin in the 'Voyage of the *Beagle*.' Has some such action taken place here with the result that the climate has been changed, and the general vegetation impoverished with a reaction involving the extermination of the goats themselves?

Our party reached the general rendezvous on the shore at 4.30, after an exhausting climb. The tide had risen, and we were cut off from the place of meeting by a high rocky point, which had to be climbed after an attempt by Captain Scott and myself to wade round it. Respect for specimens, camera, gun, etc., caused us to abandon this when we found the water breast-high.

Lieut. Shackleton, who had followed us, made an interesting and useful general collection and an acute series of observations. He obtained from a gannet's nest a specimen of a leguminous plant, no doubt the kind referred to by Mr. Knight as growing on the other side of the island, from which the bird had transported it. He took water-samples from the streams, and has since analyzed them, and obtained some photographs of birds and their nests. Like the rest of us, he was too heavily laden for climbing easily among the rocks.

Mr. Skelton made an adventurous journey by himself—a rash proceeding in such a place—eventually reaching a point where he could see across the island, though nowhere near the highest point. He went eastwards in the direction of the Monument, and steadily pursued his special task of observing and collecting birds and their eggs. In this he was particularly successful. On returning, he, on his part, was also cut off by the tide, and found himself in a very dangerous situation, where he could neither advance nor retreat. He managed to lower his gear, and then climb up the cliff and work his way round,

arriving just as the whole party was assembled. He had carried too much, and in the later stage of his journey suffered from cramp. His bag was 7 petrels and 4 eggs; 4 gannets and 3 eggs; 4 terns and 3 eggs. Unfortunately, these eggs were broken in the boat on returning.

On the reassembly of the whole party at the rendezvous, the tide was found to have cut us off from the "natural pier" mentioned—it was a very natural pier indeed—but it was safely reached through the surf, the first waders carrying out a line with them. As the faithful

GANNET'S NEST ON TRINIDAD ISLAND, 1100 FEET.

Cross led the way, I followed him, and we had the reward of our temerity in getting off very cheaply—the rest of the party thoroughly enjoying their varying fortunes. One member fought a little shy of the ordeal, and deservedly came off worst, to the huge delight of his friends. The whole party reached the *Discovery* at 6.10 p.m.

Lieut. Armitage had swung the ship during our absence, and Lieut. Barne had practised with sounding-gear, water-bottle, etc. Before setting out in the morning a fish-trap had been lowered and buoyed,

On hoisting it in, it was found to contain only the bait. Nothing was caught by the hand-lines from the ship—two negative results that are surprising after Mr. Knight's experience in the *Falcon* and that of our men in the boats close in shore.

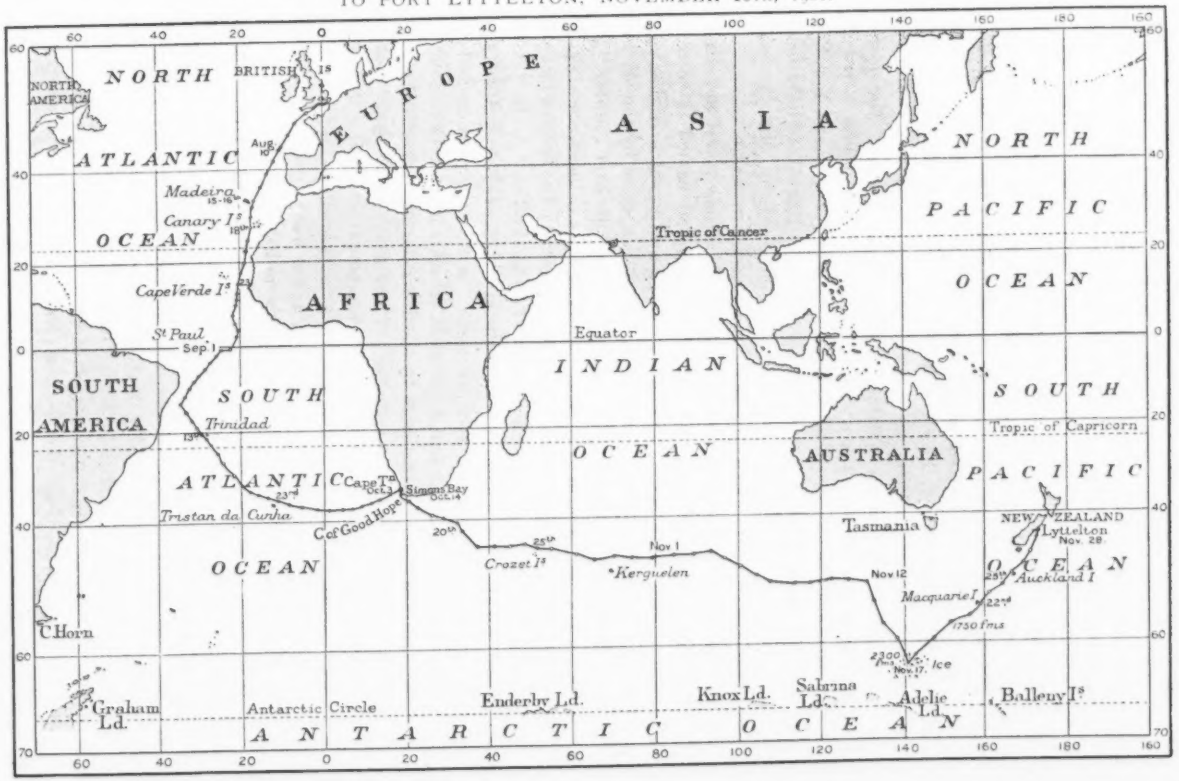
Mr. Ferrar made an interesting series of geological observations, and his specimens have been examined by Mr. G. T. Prior of the Mineral Department of the British Museum. Mr. Prior recently examined the specimens collected by Sir James Clark Ross on his outward voyage, and has, I fear, anticipated Mr. Ferrar's observations. In his paper in the *Mineralogical Magazine* (vol. xii. No. 58) he describes the Ninepin rock as of phonolite, and quotes Mr. Knight's description of the whole island as rotten and toppling to pieces—a very graphic description of the place. He goes in detail through the mineral structure of the island, and makes an interesting comparison of it with Fernando Noronha. "The characters of these rocks, as well as many of the geological features of the island, such as the remarkable peaks of phonolite associated with basaltic lavas, suggest analogies between Trinidad and the island of Fernando Noronha, off the coast of Brazil, a thousand miles to the north, so that it appears possible that the two islands owe their origin to a very similar, if not contemporaneous, volcanic outbreak." In a letter he says of Mr. Ferrar's specimens, "The rocks do not differ much from those collected by the Ross expedition," and in this department we have been unluckily anticipated.

I have already alluded to the extreme barrenness of the island from a botanical point of view. Two plants belonging to the Cyperaceæ, both endemic, clothe the valley we ascended. The predominant form is *Cyperus atlanticus*, Hemsl., and a rarer form is *Fimbristylis nesiotis*, Hemsl. Dr. Copeland, the astronomer, landed here in 1874, and collected a number of plants referred to in the *Challenger Reports*, Botany, iii. p. 123, by Mr. Hemsley. He was more fortunate in some respects than we. He obtained nine phanerogams, four ferns, and four lichens. The tree-fern, which forms so remarkable a feature of the higher ground, is *Cyathea Copelandi*, Kuhn and Luerss., also an endemic species. In addition to the ferns found by Dr. Copeland, we found three others, *Pteris palmata*, a *Nephrodium*, and another not yet determined, besides a moss (*Isopterygium*) and an Hepatic (*Eulejeunea*).

Even the fresh-water algæ from the cascade give barren results. We got three lichens, *Ramalia anceps*, Nyl., a West Indian form; *Usnea barbata*, var. *rubigina*, Meyer and Fest., a very widely distributed form; and *Parmelia latissima*, Fee, var. *insidiosa*, Müll. Arg., also widely distributed. The bean collected by Lieut. Shackleton from a bird's nest, and so often referred to by Mr. Knight in his later book, 'The Cruise of the *Alerte*,' is *Canavalia obtusifolia*, L., a widespread tropical form, also obtained on the island by Dr. Copeland.

Sir George Hampson informs me that it will take a long time to

TRACK OF THE S.S. "DISCOVERY," FROM COWES, AUGUST 6TH, TO PORT LYTTELTON, NOVEMBER 28TH, 1901.



work up the insects. Mr. Pocock furnishes me with the following note: "The spiders collected in the island of Trinidad are referable to five species, of which I have been able to identify only two—namely, *Heteropoda venatoria*, the ubiquitous house-spider of the tropics, and *Tetramatha nitens*, Aud., also a widely ranging tropical form. There are also two specimens of a *Plexippus*-like attoid spider, one example of species of *Aranea*, and several immature specimens of a species of *Leucauge*." Mr. Knight frequently refers to the land-crabs as "loathsome" and "unlike any I have ever seen," etc. They are quite common and widely distributed. The two crabs we found—and they made no terrible impression upon us—are *Gecarcinus lagostomus* and *Grapsus maculatus*. The fishes obtained by Mr. Hodgson and the men in the boats are: *Muraena punctatofasciata*, Blkr.; *Epinephelus merra*, Bl. *Glyphidodon bengalensis*, Bl.; *Platyglossus cyanostigma*, C. and V.; *Clinus nuchipinnis*, Q. and G.; *Acanthurus chirurgus*, Bl. Schn.; *Balistes buniva*, Lacép.; *Balistes maculatus*, Gm.; as determined by Mr. Boulenger. They are all well known, and call for no special remark.

The birds belong to seven species, of which one petrel appeared to be new to science, and Dr. Bowdler Sharpe had named it *Œstrelata wilsoni*. The other species, which was found nesting at a higher elevation than *O. wilsoni*, was *O. trinitatis*, a petrel discovered by the *Magenta*, and not hitherto represented in any museum in this country. The frigate-bird procured was, curiously enough, the smaller species, *Fregata ariel*, and not the larger one, *F. aquila*, which was the species met with on South Trinidad by the Earl of Crawford in the *Venus*.

Mr. Knight's description of South Trinidad as "the hottest, most depressing, and uncanny spot on earth" is no exaggeration, but the place, apart from its unfound piratical treasures, has a fascination for the naturalist that is not abated by the discomforts of travelling over it.

Perhaps the principal excitement of our southward voyage was the constant experiment with protected tow-nets. One evening I drew the plans of Mr. Blackman and myself of a torpedo-shaped protected net. Captain Scott summoned the carpenter, and it was at once put in hand. It answered fairly well, but the trials were hardly in progress before he began a fresh series of experiments with canvas covers instead of wooden shields. In fact, between microscopical work and tow-netting, I began to feel the captain was rapidly usurping the director's place, and it gave me unqualified pleasure to know that these departments would be so enthusiastically looked after when I had left the ship. The rival nets were still in competition when Captain Scott made a most important invention, viz. that of very long and very narrow nets without any protection. With these (which I shall describe elsewhere) we were able to tow-net up to 10 knots without any protection whatever. They were so successful that we for the time abandoned all the experiments with protected nets.

Two events relieved the monotony of the later stages of our voyage. One was the discovery by Dr. Koettlitz of a new Peridinian, which was named *Peridinium Scottianum* after our commander. The other was the capture by myself of a new generic type of pelagic unicellular alga. There was a general petition to call it after the ship, but I think the ship will yet be commemorated in this way, and I prefer, with the President's permission, to call this first generic type *Markhamia pelagica*.

Looking through my scientific diary, I find much to interest the naturalist—less of general interest, and in my private diary nothing that would be other than merely humorous.

III. THE "DISCOVERY" AND THE RELIEF SHIP.

By Sir CLEMENTS R. MARKHAM, K.C.B., F.R.S., President R.G.S.

When the National Antarctic Expedition left Simon's bay, it may be considered to have entered upon its real work. During the fifty-two days of the voyage thence to New Zealand experience was acquired respecting the adaptability of the ship to her work, respecting the qualifications of officers and men, and respecting the organization of all the various scientific investigations.

Favourable and hopeful reports on all these points cannot fail to encourage us in our hopes for the success of the great enterprise on which this Society has entered, in conjunction with the Royal Society.

First, with regard to the design of the ship. The spell of bad weather from October 27 to November 3, when a succession of westerly gales were experienced, was the first real test of the ship's seaworthy qualities. From this point of view she proved entirely satisfactory. At times it blew very hard, with heavy cross-seas, and the squalls burst in violent gusts of wind and hail or snow. It was found that the good ship rose easily and lightly to the heaviest seas, was wonderfully stiff under canvas, and surprisingly dry. Captain Scott had expected the possibility of shipping seas over the stern when running before heavy weather, and consequently some risk of broaching to. He was, therefore, agreeably surprised to find that no such danger exists. The ship has proved to be, in all respects, an excellent sea-boat. For this the Societies have to thank Mr. W. E. Smith, the designer, and one of the chief constructors of the Navy. He has given us his experience and his great abilities, almost as a labour of love, and has designed for us by far the best ship that ever entered the polar seas. He not only had to consider the lines of modern polar ships, but he also had to take into account the extreme difference of sea conditions between the

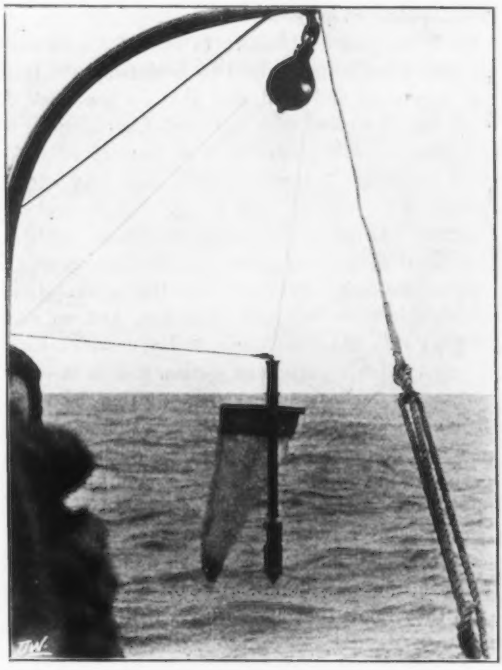
northern and southern polar oceans. Captain Scott attributes the ease with which the *Discovery* rises to heavy following seas entirely to the rounded shape of the stern, which he thinks will also give her a great advantage in the ice, notwithstanding the severe criticisms it met with at home. A good sea-boat is usually what seamen call "lively," and the *Discovery* proved anything but an exception to the rule. She was tossed about like a cork on the big seas, and rolls up to 43° have been recorded. Some nonsense has appeared in the newspapers about her

THE CROW'S NEST ON THE *DISCOVERY*.

excessive rolling. I should like to have the people who write about it on board a Symondite frigate off the Horn for a month. Then they would know what rolling is. The *Discovery* has never rolled a degree more than she is perfectly justified in rolling. Her greatest run during twenty-four hours was 223 knots, and 200 knots was exceeded on several occasions.

The question of the leaking of the ship is quite another matter, and is wholly unconnected with her design. It is a question of workmanship.

The leaking in the holds and engine-room had been continuous since the ship left England, and a bad leak had been sprung in the fore peak after entering the pack-ice. On reaching Lyttelton, she was making sufficient water to necessitate more than an hour's work at the hand-pumps daily. I cannot say anything, on the present occasion, about the blame, for the matter must be considered at present to be *sub judice*. But Captain Scott very properly would not start on his



THE GARSTANG NET.

antarctic voyage with the prospect of such continuous labour at the pumps.

The *Discovery* was taken into dock at Lyttelton in December, and the work was carried out by Mr. R. J. Miller in the most thorough manner possible. The ship was caulked throughout, and the leaks were practically stopped, except in the fore peak. Those interested in the Expedition, and especially the friends and relations of those on board, now have the satisfaction of knowing that the leak is no longer serious, and that the amount of water made forward in a day can be pumped out in ten minutes. For this result our cordial thanks are due

to Mr. Miller, and our other friends in New Zealand. You must clearly understand that there is absolutely no danger from the leak; only annoyance and a little extra labour. The holds are as full as it was possible to stow them, and the officers have absolute knowledge of what is on board and where each particular article is stowed. The ship contains provisions for two years and nine months, and by careful stowage they were able to start with 285 tons of coal in the bunkers, and a deck load of 65 tons, altogether 350 tons. On the upper deck were also 45 sheep and 23 dogs.

Captain Scott has proved himself to be the *beau ideal* of a polar commander. The Presidents of the two Societies have full confidence in his ability, judgment, and skill, and that he possesses those higher qualities which fit him to lead men in times of hardship and peril. We firmly believe that he will secure such a measure of success as the mighty powers of nature arrayed against him may render possible. We ask no more.

Our commander is an expert as regards some of the scientific subjects to be investigated, and those the most important; and he is specially fitted for the direction of the scientific work. It is a difficult position, requiring infinite tact and judgment, and no man is better qualified to occupy it. His principle is to leave each man a maximum amount of freedom in his particular duties, and it is one which will work admirably. As regards supervision, all that he requires is that each member of the scientific staff shall keep a summary of his work in the captain's cabin, and write it up weekly. These books are open to the inspection of all the others, so that each man knows at once where to get information respecting the work of other departments, and can correlate his own results at any time. With regard to special work that members of the scientific staff may wish to do, or points of interest that occur to them, the captain takes opportunities of talking it over with them, and they know that he is always willing to help their work when possible.

His method has borne the test of success, and nothing can be more satisfactory than the genuine feeling of loyalty and good comradeship that exists throughout the expedition.

The executive officers have now acquired the only thing they needed, which was experience. It was said that they were too young and inexperienced. This can be said no longer, for out of 115 days since leaving England, they have spent 107 at sea, and most of them under sail. Lieut. Royds, especially, has shown that he possesses all the qualities of a seaman. The men are thoroughly up to their work, and, with a knowledge of the arduous character of the service, are in the keenest spirits to undertake it. They understand the situation, and with them there will be no difficulty, under such a leader, in enforcing disciplinary measures for purposes of health or with

other objects. Amongst the officers there has not been a single disagreement during their voyage of 15,000 miles.

Lieut. Armitage, with Lieut. Michael Barne as his assistant, has charge of the magnetic observations. All that he does is well done, and his sound judgment is never at fault. It was to secure some important magnetic results that the *Discovery* shaped her course to the southward in about 130 E. Here was supposed to be the centre of magnetic intensity. The first ice was, of course, an important event. It always has been so in polar voyages. I remember inducing the present Captain Egerton to charge his first ice on board the *Alert*. But it was rather a formidable piece, and brought the ship up all standing. Sir George

LOOSE PACK-ICE.

Nares was not best pleased. But there was no such danger in the *Discovery's* first ice. Michael Barne was officer of the watch, on a dull snowy morning, and he gleefully shouted, "Ice on the port bow!" It was a piece about 2 feet square. Soon after the good ship was christened by a fair-sized piece striking her bows. It was on Saturday, November 16. At noon they met long streams of ice, and in the afternoon a sounding was taken, bottom being reached in 2200 fathoms. Lieut. Barne has charge of the sounding operations. In the first watch they reached a close pack of ice, and were obliged to turn the ship's head to the north, much pleased and interested by their ice experience. It has given all on board great confidence in the ship, and in the way she forced herself through ice many feet thick. It is a point of considerable

interest that, with the exception of a small berg piece, no icebergs were seen on this meridian either within or outside the pack. Captain Scott touched at Macquarie island on the way north to New Zealand, in order to make collections, reaching Lyttelton on November 30.

The work apportioned to the officers, in addition to watch-keeping and their scientific duties, will interest the meeting. Royds has charge of the upper deck and of all the top hamper on the skids, for the security of which, in the long succession of bad weather, he merits the highest credit. Barne has the ward-room and lower deck. Shackleton has the galley compartment, and charge of all the stores, issuing them each day at four o'clock. He also goes round to the men's tables every day, to see that they are satisfied, and to give them frequent opportunities of making any complaint. Skelton, though fully occupied with the work of the engine-room, also takes charge of the dark room, and stores all negatives of interest. Dr. Wilson has a marvellous capacity for work, while his really wonderful artistic talent will be invaluable. But all are equally good and equally zealous, happy among themselves, and full of loyalty to their chief.

I cannot refrain from mentioning a proof of Lieut. Armitage's excellence as a navigator. They sighted Macquarie island exactly at the time and in the direction expected—a very satisfactory fact after a voyage of fifty-two days without having once sighted land during the whole time.

The meeting will be interested to hear some details of the scientific work that has been done by our explorers during their voyage from the Cape to New Zealand. It is true that some of it is tentative, and that there will be completer results when more experience has been gained; nor have the full reports yet reached us. But it all shows the zeal and intelligence with which our explorers are working, and gives rich promise of future results.

The magnetic observations have been continuous over a long and important line, and have also been carried south to 63°. This valuable work was conducted under the greatest difficulties, for the lurching and "sending" (or bodily transference) of the ship affects the inertia of the magnetic needles, and is especially disadvantageous to the observations. The object of going south more or less in the line of no variation was to observe the changes of force. The observations seemed to show a very gradual increase of force as the pole was approached. There are other points of interest in the observations for dip and variation, but the full report has not yet been received. Lieutenants Armitage and Barne, as magnetic observers, were reinforced at New Zealand by their colleague Mr. Bernacchi, with the self-registering *eschenhagen* instruments. Mr. Bernacchi, as a zealous, untiring, and intelligent observer, is a great acquisition. Moreover, he not only unites with his colleagues in loyalty to Captain Scott, but speaks of him, in his letters, in terms of warm affection.

The meteorological report and observations have not yet reached us, but we know the conscientious steady way in which Lieut. Royds keeps the records, and we may feel sure of good results from such a first-class worker. Mr. Shackleton continued his determinations of the specific gravity of sea-water throughout the voyage, obtaining samples twice a day, and using two methods—that of specific-gravity determinations by Buchanan's hydrometer, and that of chlorine determinations. Mr. Ferrar took great pains with his observations for electricity in the atmosphere, but it is most difficult to charge or keep the instrument

WAKE OF THE *DISCOVERY* THROUGH THE PACK.

charged at sea. He also worked at the atmospheric carbonic anhydride determinations by the method suggested by Prof. Letts.

Lieut. Barne has charge of the deep-sea sounding apparatus. On three consecutive days, November 15, 16, and 17, soundings were obtained in 2530, 2380, and 2360 fathoms in latitudes 59° 35′, 62° 20′, and 61° 42′ S., and another in 1740 fathoms in 56° 8′ S. But the sounding-machines when supplied were out of adjustment, and they can only be properly adjusted by experimenting with them, so that much fuller and more complete results may be expected hereafter. The Hansen-Pettersen water-bottles will also be of great value, and they will enable the explorers to ascertain the existence of warm and cold layers of water in the ocean depths. Two of these valuable instruments have been supplied by the Antarctic Finance Committee, and one by the Admiralty.

The materials brought up by the sounding-tube, after the four deep-sea soundings, were carefully examined by Mr. Ferrar, who has made a report describing the results of his examinations.

Mr. Hodgson's biological work has been confined to the *plankton*, as exigencies of time rendered it necessary to make passages, and made it impossible to arrange the stoppages for biological work which were originally intended. Even the orthodox gear for *plankton* could not be used when the ship was going more than 7 knots. In order to remedy this state of things, Captain Scott devised a small tow-net 3½ inches in diameter, which answered the purpose well. Several were made on board, and have been in constant use. For *protozoa* and *protophyta* these high-speed nets have proved invaluable, but for the larger and more bulky organisms, only a few could bear the strain. Delicate animals were hopelessly crushed. The *amphipoda* seem to have stood best, and form the most important part of the collections. Of course, there will be a very different state of things when the ship begins its real work in the Antarctic regions, without the necessity of making passages. A collection register will be kept throughout the voyage, and Mr. Hodgson will work through the collections during the winter, identifications being recorded in the proper places in the register. The collection of *plankton* during the voyage from the Cape to New Zealand has been sent home in 102 tubes enclosed in twelve bottles, with a full report on the specimens. Dr. Koettlitz has sent home a report on the *phyto-plankton;* Captain Scott reports that both these members of the scientific staff have worked zealously, and have done their best under very difficult circumstances.

A good ornithological collection was made both in the ice and at Macquarie island. Six different kinds of fulmars and petrels were obtained while the ship was among the ice in 63° S. Before reaching New Zealand, Captain Scott came to the wise decision that it would be desirable to devote a few hours for landing at Macquarie island, a spot of great interest to the naturalist. So he anchored at Fisherman's cove, within half a mile of the shore.

The island on the east side is green, owing to a luxuriant growth of tussach grass, but the western faces of the hills were wind-swept and bare. It is about 22 miles long by 5 broad. A considerable portion was explored by Mr. Ferrar, who has sent home a report on the geology, and collected geological specimens. He discovered raised beaches showing the periods of rest in the elevation of the island, and he describes other points of geological interest observed during his excursion inland.

With regard to the fauna, there were two extensive penguin rookeries, where the birds were in thousands, and of two species—the King penguin and the gold-crested broad-billed kind. Arriving in the breeding season, the naturalists were able to collect the birds in various

PENGUINS ON MACQUARIE ISLAND.

stages of maturity, as well as their eggs. Specimens of the southern skua, the giant petrel, and a black-backed gull were also collected. Mr. Hodgson shot about ten landrails, known as the "Rothschild rail," which I understand are rare. Whilst many of the party were engaged in making zoological collections, Dr. Koettlitz obtained a considerable number of botanical specimens, and at 8 p.m. the shore-parties returned to the ship. The results are that six cases of bird-skins have been sent home; and a case containing pressed plants, tubes of fresh-water algæ, fungi, worms, and insects, and geological specimens.

The visit to Macquarie island offered the first opportunity for the explorers to become acquainted with the taste of penguin flesh. On Sunday, November 24, a penguin stew was prepared, and Armitage wanted to cook it in Worcester sauce, a glass of Madeira, and a glass of port. But Shackleton and Wilson, the mess and wine-caterers, declared that the stores would not stand such waste, and the penguin had to be cooked without that epicurean sauce. Shackleton pronounced it to be all right, and that it had the merit of being fresh, but he would not ride a mile to eat it. Royds highly approved of scrambled penguins' eggs for breakfast, and thought the roast penguin at dinner very good. The men had it boiled. Some liked it and some did not. Captain Scott had anticipated considerable prejudice on the part of the men to this form of diet, which it will so often be necessary to enforce, and he was agreeably surprised to find that they were by no means averse to it. Many pronounced it excellent, and all appreciated the necessity of cultivating a taste for it.

I look upon this memorable voyage, with its wild weather inuring our young explorers to rough practical seamanship, with its opportunity of first seeing the streams of Antarctic ice, with its visit to a sub-Antarctic island, as the first training-ground of the Expedition. Here the first eagerness for hard work and novel scenes were in some sort gratified. In imagination we see our young, but no longer inexperienced, explorers imping their scientific wings, and preparing for higher flights in the vast region of the unknown South.

How anxiously we all hope that these preparations were an earnest of all the success that we and they can desire! We cannot know or hope to know what obstacles they have met for a long time, but all we know of this long voyage, and of their work during those fifty-two days, fills our hearts with confidence—with confidence in the high qualities of officers and men, and, above all, with confidence in their able and trusted leader.

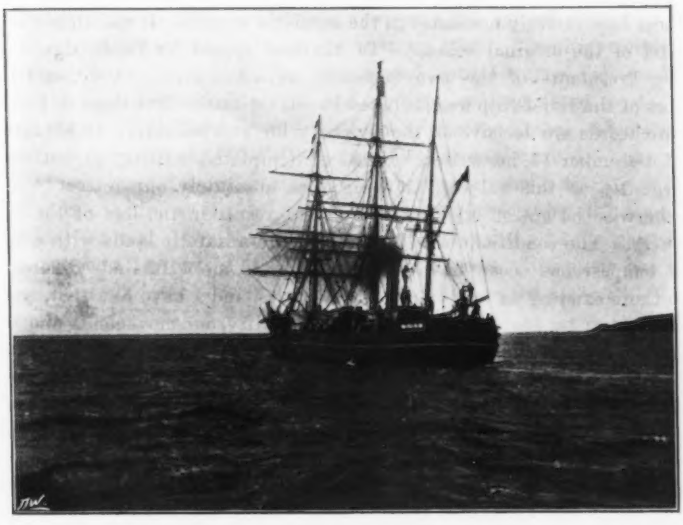
From Macquarie island the *Discovery* proceeded to the northward. On the morning of November 25 Auckland island was sighted, and on the 29th they reached the harbour of Lyttelton.

Nothing could exceed the kindness and hospitality of the people of Lyttelton and Christ Church, and the interest taken in the expedition throughout New Zealand. It amounted to enthusiasm. There is good reason to hope that the colony, following the noble example of Queensland, will vote a grant of money towards the expenses of the Expedition. The two Societies owe their special thanks to our associate, the Hon.

OFFICERS AND STAFF OF THE *DISCOVERY* LEAVING NEW ZEALAND.

C. C. Bowen, who has long advocated the passing of such a vote; to Mr. Coleridge Farr, of the magnetic observatory at Christ Church; to Mr. Miller, who stopped the leak; to Mr. Rhodes, whose hospitality was unbounded; and to Mr. Waymouth, the Managing Director of the Frozen Meat Company, and Chairman of the Harbour Board. All harbour and dock dues were remitted, and everything was done by these gentlemen and others to further the objects of the Expedition.

And so, with all these kind attentions and cordial good wishes at the last port, the memories of which will long be cherished by them, our gallant explorers have sailed forth into the unknown. By this time



LAST VIEW OF THE *DISCOVERY* FROM LYTTELTON.

the *Discovery* has passed through the pack, and had many encounters with the ice. Exactly sixty years ago to-day, Sir James Ross reached his furthest eastern point along the great ice-barrier. He saw the appearance of land far to the east, but the bay ice was beginning to form. We hope that, with the help of steam, the *Discovery* has already done much more. But we can only hope. A long and weary and anxious time must elapse before we can know. Those gallant men we have sent forth to add lustre to the annals of their country are now facing perils and hardships of no ordinary character. We, who have sent them, are sitting comfortably at home. But we have a duty, a bounden and urgent duty, which we cannot shirk. We must see that sufficient funds are subscribed for the despatch of the second ship—the relief ship.

I hear that it has been said that the second ship is an afterthought. An afterthought indeed! Why, I have been urging the necessity of sending a second ship after the first winter of every polar expedition for the last thirty years. The terrible Franklin disaster was due to the neglect of this precaution. It has always been taken since. In 1875 I wrote a pamphlet on the subject, which induced the Government of that day to engage Sir Allen Young to go in search of Sir George Nares's expedition in the *Pandora*. In 1881, when Mr. Leigh Smith did not return, we applied to the Admiralty, and at once obtained a grant of £5000 and permission to employ naval officers.

If such a precaution is necessary in the arctic regions, it is assuredly most imperatively necessary in the antarctic regions. It was an essential part of the original scheme. In the last appeal for funds, signed by the Presidents of the two Societies, we asked for £120,000, and the cost of the relief ship was included in our estimate. But Captain Scott's own words are decisive on the necessity for a relief ship. In his letter of December 17, he writes, "I had contemplated writing to you most urgently on this subject, knowing how absolutely our retreat would otherwise be cut off should any accident result in the loss of the *Discovery*. The conditions which surround the antarctic lands with a belt of tempestuous ocean have always impressed me with their difference to those existing in high northern latitudes, and I have felt that, since our retreat by boats is a practical impossibility, our movements and the risks we could rightfully take must be greatly limited, if the loss of the ship of necessity implied the loss of all on board. Though I understand that the funds for a relief ship are not yet fully subscribed I see that its objects are thoroughly considered, and that every effort will be made to despatch, at the right time, the vessel which you have already purchased for the purpose. It will, therefore, be a great relief and satisfaction to me to leave Lyttelton, confident that such efforts will be successful, and that a line of retreat is practically assured us."

With this firm faith in their countrymen, our gallant explorers have entered the unknown. How can there be any answer but one to such an appeal? Captain Scott has given us details of his arrangements, and named places where depôts are to be stored. He knows that, in the possible event of the loss of the ship, all hands must perish unless succour is sent. Is it to be sent or not? Imagine a retreating party, with extreme difficulty and in terrible distress, reaching the place for one of these proposed depôts, in full hope and confidence, and finding—nothing; that their countrymen would not subscribe the funds. Such an event is too horrible to contemplate.

I do not believe a word of it. I have worked hard to collect funds in spite of refusals, rebuffs, and snubs; but I still have a firm belief in the generosity, humanity, and patriotism of the majority of my

countrymen. If a relief ship is sent, there is no undue risk; but it *must* be sent, and the funds must be raised. There are now several zealous workers who are leaving no stone unturned, and are confident that the necessary amount will be forthcoming. Within the last fortnight there have been several hopeful signs.

Last week H.R.H. the Prince of Wales, Vice-Patron of the Expedition, sent for me to tell him what had been done with a view to the despatch of the relief ship. As a sailor, and as a patriotic Englishman, His Royal Highness saw the necessity for raising the necessary funds and affording the needful succour to our explorers, and he sent a liberal subscription. The Royal Society, with the same conviction, has subscribed £500. The Goldsmiths' Company has set what may prove to be an important example, by subscribing £200. The Fishmongers' Company has subscribed £100. Our second appeal to the Fellows has brought in a considerable sum, and I hope will continue to do so. Our very cordial thanks are due to the numerous liberal subscribers, yet even now, out of 4020 Fellows only 400 have subscribed.

After a careful consideration of the various recommendations of the few wooden ships at Dundee and in Norway which still exist, I came to the conclusion that the *Morgen* (or *Morning*) of Tonsberg, in Norway, was the only one that would at all answer our purpose. Her name has not been changed, because it is very unlucky to change the name of a ship, especially of a Polar ship. She was built in 1871, but as she is perfectly sound her age is no disadvantage. The old *True Love*, a whaler well known to me when I was in Baffin bay, was then sixty years old, and as sound as when she was launched. When she was broken up at the age of one hundred years, her timbers were so sound and good that they were not used for firewood, but sold to Blundell Maple to make choice oak furniture. I had known the *Morning* since 1897, and at one time I thought of her as the ship for the main expedition. She is a vessel of 450 tons, and of quite remarkable strength; indeed, I should think the strongest whaler that was ever built. In one respect she is too solid, for she draws so much water when empty, that she may not be able to carry the quantity of coals and stores that we should be led to expect from her tonnage. However, she is the best vessel to be had, and, with the approval of our Council, I bought her and had her brought across to the Thames. She is now in the hands of Mr. Green for necessary alterations. In our associate, Mr. William Colbeck, of the Royal Naval Reserve, an efficient and zealous commander has been found, who is already acquainted with Antarctic ice navigation; and I believe that he will be able, without much difficulty, to select capable officers and a good crew from the numerous volunteers. Captain Scott has given us his wishes in detail, with regard to the procedure of the relief ship, and the carrying out of those wishes will largely be left to Mr. Colbeck's discretion. All we need are the funds for the equipment and despatch of the *Morning*.

I entreat all present to remember that our gallant friends are now braving hardships and dangers for science and for their country's credit, *and at our behest*; that they are working in full faith and belief in us and that we will send them succour; and that we are all bound, in our different spheres, to work for the great end of collecting sufficient funds to send out the relief ship next June.

APPENDIX.

FINAL LIST OF OFFICERS AND CREW OF THE "DISCOVERY" WHO ENTERED THE ICE.

1. *Commander*—ROBERT FALCON SCOTT, born June 6, 1868. He entered the navy in 1886. In the *Rover* (Training Squadron) for a year, 1887–88. With Captain Hulton in the *Amphion*, 1889; and navigator in the *Sharpshooter* when Captain Auton reported him to be "a good navigator, zealous and attentive." Torpedo lieutenant serving under Captains Hall, Durnford, Robinson, and Jackson. He was four years in sailing ships, Torpedo lieutenant of the *Majestic*, 1898–99, when Captain Egerton strongly recommended him for the Antarctic command. He went through a special *course of surveying*, 1892–93; and for magnetic observations, 1900. *Commander*, June 30, 1900. M.V.O., F.R.G.S.

2. *Navigator and Second in command*—ALBERT B. ARMITAGE, *Lieut.* R.N.R. Chief officer P. and O. service. Born July 2, 1864. *Worcester cadet* 1878. 1894–97 he was the scientific observer in the Jackson-Harmsworth Expedition, and saw much ice navigation and sledge travelling. On June 5, 1899, he received the *R.G.S. Murchison Award*. In charge of the magnetic observations.

3. *First Lieutenant*—CHARLES W. RAWSON ROYDS, born February 1, 1876. Nephew of Admiral Sir Harry Rawson, and of Commander Wyatt Rawson, the distinguished Arctic officer. *Conway cadet*. In the *Champion* (Training Squadron) under Captain Cross; then in the destroyer squadron at the Nore under Commander de Robeck; then in the *Crescent* flagship, W.I. *Lieutenant* R.N., F.R.G.S. In charge of the meteorology, and went through a course of magnetic instruction. Musician, vocal and instrumental. He is a thorough seaman. He went to the Ben Nevis Observatory during the winter 1900.

4. *Second Lieutenant*—MICHAEL BARNE, born October 15, 1877, *Lieut.* R.N. Served in H.M.S. *Majestic* and in China. He went up to the Ben Nevis Observatory during the winter 1900, and through a course of magnetic instruction. Assistant magnetic observer, and in charge of the sounding apparatus. Also in charge of the wardroom and men's deck.

5. *Third Lieutenant*—ERNEST SHACKLETON, born November 4, 1874. He entered the merchant service in 1890, and served in sailing ships in the Pacific, afterwards in the *Castle* line. *Sub.-Lieut.* R.N.R., F.R.G.S. In charge of sea-water analysis. Ward-room caterer. In charge of the holds, stores, and provisions, and arranges and serves out provisions. He also arranges the entertainments.

6. *Engineer*—Reginald Skelton, born June, 1872, Engineer R.N. Photographer, charge of dark room and negatives. In charge of the dynamo apparatus, condensing, &c.

7. *Surgeon and Botanist*—Reginald Koettlitz, born December 23, 1861, student of Guy's. In country practice seven years. 1894-97 he served in the Jackson-Harmsworth Expedition as surgeon. An expert as regards phyto-plankton. Bacteriologist. His bacteriological apparatus was presented to him by former students of Guy's Hospital. In charge of the port laboratory.

8. *Surgeon and Vertebrate Zoologist*—Edward Wilson, born July 23, 1872. Surgeon at Cheltenham. M.B. In charge of the xanthometer. Dr. Wilson possesses great artistic talent both for painting landscapes and animals. He is wine-caterer.

9. *Physicist and Magnetic Observer*—Louis C. Bernacchi, born Nov. 8, 1876, in Tasmania. Two years at the Melbourne Observatory. Magnetic and Meteorological Observer in the Newnes Antarctic Expedition. Author of a paper on the "Topography of S. Victoria Land" read at the R.G.S. meeting on March 18, 1901, and of 'To the South Polar Regions,' a narrative of his Antarctic experiences. He went out with the Eschenhagen magnetic instruments, joining the *Discovery* in New Zealand. F.R.G.S.

10. *Biologist*—J. V. Hodgson, born Feb. 19, 1864, in Birmingham. He had been curator of the Plymouth Museum. In April, 1901, he went for a cruise in the Norwegian dredging and sounding vessel *Michael Sars*. In charge of the starboard laboratory.

11. *Geologist*—H. J. Ferrar, born on June 28, 1879, at Dalkey, co. Dublin. A Cambridge graduate and geologist. In charge of the atmospheric carbonic anhydride determinations suggested by Prof. Letts. In charge of the laboratory on the lower deck.

12. *Assistant Engineer*—J. H. Dellbridge, aged 29. Artificer in the engine-room, and attends to the top hamper on the skids. From H.M.S. *Majestic*. R.N.

13. *Boatswain*—J. Alfred Feather, aged 31, born at Great Yarmouth. Came from H.M.S. *Boscawen*. Attends to the top hamper on the skids, under Lieut. Royds. R.N.

14. *Carpenter*—Frederick C. Dailey, aged 28, born at Portsmouth. From H.M.S. *Ganges*. Served his apprenticeship in a wooden shipyard. Reported on the condition of the hull of the *Discovery* with regard to the leaks at Lyttelton. R.N.

Petty officers, 5 (all naval).

15. Edgar Evans, aged 26, born at Swansea. Came from H.M.S. *Majestic*. R.N.

16. David Silver Allan, aged 30, born at Montrose. Came from H.M.S. *Majestic*. *Married*. R.N.

17. Jacob Cross, aged 25, born at Little Clacton. R.N.

18. William Macfarlane, aged 27, born at Forfar. R.N.

19. Thomas Kennar, aged 26, born at Brixham. Came from the *Magnificent*. R.N.

Able seamen.

20. William Smythe, aged 27, born at Portsmouth. Came from the *St. Vincent*. R.N.

21. James W. Dell, aged 23, born at Worthing. Came from the *Pembroke*. Plays the mandolin. R.N.

22. William L. Heald, aged 25, born at York; instructed in ballooning at Aldershot. R.N.

23. William Peters, aged 22, born at Cork. Came from the *Magnificent*. R.N.

24. Arthur Pilbeam, born at Worthing; home at Hastings. Came from the *Mars*. R.N.

25. Frank Wild, aged 28, born at Skelton, Yorkshire; home at Eversholt, near Woburn. Came from the *Vernon*. R.N.

26. Thomas Soulsby Williamson, born October 6, 1877, in Sunderland. Came from the *Pactolus*. R.N.

27. George Beaver Croucher, from Grimsby, aged 20. Joined from the *Narcissus* at Cowes. R.N.

28. Ernest Edward Mills Joyce, aged 26. Joined from the *Gibraltar* at Simon's bay. R.N.

29. George Thomas Vince, aged 22. Joined from the *Beagle* at Simon's bay. R.N.

30. Thomas Crean, aged 25. Joined from the *Ringaroona* at Port Chalmers, N.Z. R.N.

31. John Walker, aged 24, born at Dundee. *Married. Merchant service.*

32. *Shipwright*—James Duncan, aged 31, born in Perthshire. *Married. Merchant Service.*

Leading Stokers, 6 (5 naval).

33. Arthur E. Quartly, aged 28. Joined from the *Majestic*. R.N.

34. William Lashly, aged 33, born at Hambleton, Hants. From the *Duke of Wellington*. He was instructed in balloon work at Aldershot. *Married*. R.N.

35. Thomas Whitfield, aged 32, born at Newport, Salop. Joined from the *Resolution*. R.N.

36. William Page, aged 25, born at Berwick-on-Tweed. Very strong, and sings a good comic song. Home at Sheffield. R.N.

37. Frank Plumley, aged 26. Joined from the *Gibraltar* at Simon's bay. R.N.

38. William Hubert, aged 35, from Poplar. An engine-room artificer and donkey-man. *Married. Merchant Service.*

Royal Marines, 2.

39. Arthur Harry Blissitt, aged 23, born at Grantham. Home at Brigg, Lincoln. Lance-corporal. *Ward room domestic.* R.M.

40. Gilbert Scott, aged 23, from Stapleford, near Salisbury. *Ward room domestic.* R.M.

41. *Ship's Steward*—Charles Reginald Ford, aged 23, born in London. From the *Vernon*. R.N.

42. *Cook*—Henry R. Brett, aged 35, shipped at Lyttelton. *Married. Merchant Service.*

43. *Cook's Mate*—Charles Clarke, aged 24, born at Aberdeen. A baker by trade. Cook at Ben Nevis Observatory. *Merchant Service.*

44. *Laboratory Attendant*—HORACE C. BUCKRIDGE, aged 25. Joined at Simon's bay. He had served in the Boer war, and had been a great wanderer. *Civilian.*

45. *Clerk*—CLARENCE HARE, aged 21, son of a banker at Christ Church. Joined at Lyttelton. *Civilian.*

46. *Dog Attendant*—F. C. WELLER. Had been a sailor in the merchant service. Plays the mandolin. Good at singing comic songs. Joined at Lyttelton with the dogs. *Merchant Service.*

ANALYSIS.

46 souls.
29 Naval (4 officers, 27 men)
2 Marines
2 Naval Reserve
} 33
2 Surgeons
3 Civilian Scientific Staff
} 5
6 Merchant Service *
2 Civilians (*Laboratory attendant and clerk*)
} 8
33 + 5 + 8 = 46
38 *Single.*
8 *Married*—1 Lieut. R.N.R. (*Armitage*).
2 Surgeons (*Koettlitz* and *Wilson*).
1 Petty Officer R.N. (*Allan*).
1 Stoker R.N. (*Lashly*).
3 merchant seamen (*Duncan, Walker, Brett*).

Of the crew—29 English
5 Scotch
1 Irish
} 38 English. 5 Scotch. 3 Irish.

Officers—9 English
2 Irish

After the reading of the papers, Dr. BOWDLER SHARPE said: I shall be very happy just to say a few words about the collection which has arrived at the British Museum from the *Discovery*, and which has turned out to be an excellent and interesting one. All these Oceanic islands are the refuges and places where the petrels breed. In ordinary times and for a great part of the year, these petrels are distributed over the sea, very much in the same way as other birds are distributed over land areas, and the difficulty we have is to find where the nesting-places of some of these birds are. Kerguelen island, for instance, is a great place for the nesting of petrels, and many of the West India islands are the homes of petrels in the breeding-season. In most cases they go to very high altitudes, the highest they can get on these islands, and nest on the rocky ground. Wherever you find these Oceanic islands, it is almost safe to predict that there you will find the nesting-home of some kind of petrel or other. Some petrels, I may add, are so rare—like the Capped petrel, for instance—that we only know about five specimens of this bird, and nobody knows to this minute where it nests, although it is a bird that has been found in our own country. South Trinidad is a very interesting place.

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* 1 seaman, 1 donkey-man, 1 shipwright, 2 cooks, 1 dog attendant.

Dr. Giglioli found two species of petrel on the island, one of which they called *Œstrelata trinitatis* and the other is *Œ. arminjoniana*. The first was found by the naturalists of the *Discovery*, high up on the hills of this island, and, not knowing that it was such a very rare bird, they did not bring home so many specimens as I should have liked, but they brought home a bird and eggs which were quite new, and which I had never seen before. Also they got another bird which I at first said was *Œ. arminjoniana*, but, however, it is not; it is quite a different species. They brought six specimens, and several eggs, and I have called it *Œ. wilsoni*, after the naturalist on board the *Discovery*. At any rate, it is a very auspicious beginning of the voyage that at the very first place on which they have landed they have got birds which we had not in the British Museum, and I may tell you that that is a very difficult thing to do; and they also got a new species. I should like just to add one word, before sitting down, to the meed of praise which the President and Dr. Mill and Mr. Murray have given to the naturalist and officers on board this ship. Dr. Wilson, as you will see from the sketches in the other room, is a very capable artist, and that is a point of great importance when you have a naturalist on board a ship who is able to correctly colour the bills and feet of birds, and that he does in a most admirable manner. In a few weeks will be published the Report on the collections of the *Southern Cross*, and there will be some most excellent pictures which Dr. Wilson has done for this Report. Before he went, he spent a long time working with us in the Museum at the mammals and birds he was likely to have to work on with the *Discovery*. It is owing to the loss of the notes made by the excellent naturalist of the *Southern Cross*, that Dr. Wilson has now to do over again all the work which poor Hansen had done in so able a manner. Dr. Wilson has gone with fuller knowledge than any man has possessed about seals in the antarctic regions, and from the way he has begun we may look forward to very satisfactory results—results which will reflect not only great credit upon himself, but on the whole of the Expedition.

The PRESIDENT: We have had two very interesting addresses, giving us an account of the voyage of the *Discovery* to Simon's Bay, from Dr. Mill and from Mr. George Murray, and I am sure the meeting will wish to pass a unanimous vote of thanks to them for their communications. We are also very much obliged to Dr. Bowdler Sharp for his remarks. I will not invite any further discussion, for my mind still turns to that deeply laden ship as it left Port Chalmers, and to the duties we owe to it. I cannot express to you the anxiety I feel, and which I trust many others share with me, with regard to raising the necessary funds for the relief ship. The other day I received a subscription from a little boy, of 5*s.*; I heard afterwards that he was saving up his pocket-money to buy a bicycle. Now, there was not only generosity in this, but there was very considerable self-sacrifice, and I am sure it ought to be a lesson to all of us grown-up people. You will find in the tea-room, not only the model of the *Discovery*, by which you can study that form of the stern mentioned in Captain Scott's despatch, and many sketches and interesting photographs, but you will also find there a subscription list, by which those who entertain the same feelings as I do—and I am sure there must be many here who do—will be able to add their names to the subscriptions for the relief ship.

THE GLACIERS OF KANGCHENJUNGA.*

By DOUGLAS W. FRESHFIELD.

THE Himalayan explorations on which I propose to base a few observations this evening were made in the autumn of 1899—two years ago. I have delayed offering any account of them to this Society for what has seemed to me a sufficient reason. It would have been easy, at an earlier date, to entertain you with a picturesque tour. But I was desirous not to talk about my travels to an audience which comprises at least a proportion of geographers, before my companion, Prof. Garwood, and I had had time to work out some of our results, and in particular to prepare a map, which, in contrast to its predecessor, the official survey, might, if incomplete in some portions, serve at least to indicate approximately what have never been indicated before—the glacial features of the Kangchenjunga group.

To this task Mr. Garwood has given infinite pains and patience. Using as a basis the trigonometrical determinations of the positions of the great peaks made in the course of the Survey of India or of local surveys, he has filled in and corrected the often vague or incorrect detail of existing maps by means of plane-table and other observations with the aid of the numerous photographs taken by Signor V. Sella and himself.

For nearly half a century I have been familiar with the Alps; I have visited more than once the Apennines and the Pyrenees, and have explored much of the Caucasus. I desired to see, before it was too late, some corner of the greatest mountain system in the Old World, the Himalaya.

Let me begin by explaining my reason for selecting Sikhim in preference to the Western Himalaya, where Sir Martin Conway went, and Mr. Mummery disappeared. For a traveller in search of the picturesque, a mountain's height must be measured from its visible base. The vale of the Rungeet, the visible base of Kangchenjunga in the Darjiling view, is 27,000 feet below its summit. The vast extent of the slope embraced in a single prospect gives unique sublimity to the landscape as a whole; while the succession of belts of vegetation piled one upon the other adds exquisite variety to the foregrounds through which a traveller approaches the snows. He sees at one glance the shadowy valleys from which shining mist-columns rise at noon against a luminous sky, the forest ridges, stretching fold behind fold in softly undulating lines—dotted by the white specks which mark the situation of Buddhist monasteries—to the glacier-draped pinnacles and precipices of the snowy range. He passes from the zone of tree-ferns, bamboos,

* Read at the Royal Geographical Society, December 9, 1901. The map illustrating Mr. Freshfield's journey will be published with an explanatory note in an early number, together with Prof. Garwood's address.

orange-groves, and dal forests, through an endless colonnade of tall-stemmed magnolias, oaks, and chestnut trees, fringed with delicate orchids and festooned by long convolvuluses, to the region of gigantic pines, junipers, firs, and larches. Down each ravine sparkles a brimming torrent, making the ferns and flowers nod as it dashes past them. Superb butterflies, black and blue, or flashes of rainbow colours that turn at pleasure into exact imitations of dead leaves, the fairies of this lavish transformation scene of Nature, sail in and out between the sunlight and the gloom. The mountaineer pushes on by a track half buried between the red twisted stems of tree-rhododendrons, hung with long waving lichens, until he emerges at last on open sky and the upper pastures—the alps of the Himalaya—fields of flowers: of gentians and edelweiss and poppies, which blossom beneath the shining storehouses of snow that encompass the ice-mailed and fluted shoulders of the giants of the range.

If there are mountains in the world which combine as many beauties as the Sikhim Himalaya, no traveller has as yet discovered and described them for us.

Every journey is the better for having a distinct and feasible aim, and I made mine the tour of Kangchenjunga and the exploration and delineation of its glaciers. I was recently asked, and that in a literary club, what and where Kangchenjunga is, whether it is a mountain or an island? I would not venture to impute similar uncertainty to any Fellow of this Society; but, observing that there are strangers present, I may perhaps venture briefly to remind them that Kangchenjunga is a mountain, that it is 28,156 feet in height—is therefore the third highest measured mountain on the face of the globe—and that it is situated some 350 miles nearly due north of Calcutta, and some 50 miles north of the well-known hill station Darjiling. It forms the culminating point of a group which rises on the confines of three countries: Tibet, Nepal, and Sikhim—very misleadingly called Independent Sikhim, since it forms part of our Indian Empire. If you ask me how to spell the mountain's name, I am afraid I cannot give a ready answer. The Indian Government—nay, even the Survey Department—has shown no consistency in the matter. I try to follow the form adopted in the latest official documents, but it is breathless work; they have varied in the last twelve months, and are still inconsistent.

The Kangchenjunga group is completely cut off by the Khosi valley on the west from the mountains of Nepal, and by the Teesta valley on the east from the mountains of Bhotan. In this respect it may be compared to the Bernese Oberland range, which is isolated by the Rhone and the Reuss, and, like the Oberland again, the Kangchenjunga group forms no part of a continental watershed. By crossing the lofty snow-clad spur which unites it to the Tibetan highlands, it is just possible to get round the mountain without trenching on any territory

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THE RHODODENDRONS OF THE ZEMU VALLEY.

officially recognized as Tibetan, though the present political situation in Lhonak, the western headwaters of the Teesta, is very accurately indicated in the following note in the official Roadbook of Sikhim—we now spell Sikhim mostly with an *h*, but on this point again the Indian Government is undecided—published last winter:—

"The whole of the district drained by the Naku Chu and Langpo Chu is called Lhonak, meaning 'the black south,' and is regarded by the Tibetans as their own property, and they very much resent the appearance there of any foreigner."

The Tibetans have been allowed to establish a guard and a wall across the valley containing the eastern sources of the Teesta at Giagong (a desolate spot about the height of Mont Blanc), thus holding the southern approach to the Kongra Lama pass. As in the Alps round Monte Rosa, the northern pastoral race has occupied the pastures at the heads of the southern valleys. It may reassure alarmists to know that here, as in so many other mountainous regions, it is not the passes but the gorges that form the main obstacles to invaders.

Politics, however, are outside our sphere. Nor will I, geographers though we are, spend the evening in deluging you with orographical details. For I am no believer in the system that finds favour in certain quarters—the system of putting the information properly supplied on a map into an interminable series of sentences stuffed with hard names, and calling the mixture, Science.

My object, as I have already said, was to make the tour—the high-level tour—of Kangchenjunga, passing as near the great mountain as might prove to be possible. This had never been accomplished by Europeans. In the map attached to Sir Joseph Hooker's travels in Nepal and Sikhim, published fifty years ago, a broad gap was left to the north-west of Kangchenjunga. Across this blank space was printed the following stimulating sentence:—

"This country is said to present a very elevated, rugged tract of lofty mountains, sparingly snowed, uninhabitable by man or domestic animals."

This gap had been somewhat diminished by the recent wanderings of Mr. White, the Political Agent at the Court of Sikhim, a persevering but too reticent explorer, and of Major O'Connor, who, in 1897 (as the Road-book of Sikhim published last winter informed me on my return from India), penetrated Lhonak, crossed the Chortenima La, a pass at the head of it, and returned through Tibet to Giagong.

On two separate occasions, however, native explorers—pundits employed by the Indian Survey to go where Europeans cannot—claim to have crossed this gap. With regard to the first, the well-known Chandra Das, famous for his adventurous journey to Lhasa, and now a resident at Darjiling, I permit myself to entertain some doubt whether the pass he traversed in 1879, on his way to Tashilumpo,

was identical with the Jonsong La. It is true he says so now, but in his first narrative he called it nothing but the Chatang La, and a pass named Chabok La is shown on maps some distance west of the Jonsong La (*La* means "pass"). Chandra Das's sketch-map is, unfortunately, too vague to be intelligible. But it is to be noted that the late Colonel Tanner, of the Indian Survey, tells us that the Pundit's observations placed his pass considerably west of the Jonsong La. Colonel Tanner concludes that the observations were at fault; but it is at least as plausible that the identification of Chandra Das's pass with the Jonsong La is erroneous. With regard to the second pundit, Rinsing, there is in my mind, despite his odd behaviour when with us, little, if any, doubt that he crossed our pass. This was a most remarkable feat for a native, even for a Bhootia, and Rinsing deserves very great credit for getting his party over with the loss of only two lives, at a late season of the year, what he described, probably with justice, as the loftiest and most difficult pass in this part of the Himalaya. In adopting here the word "difficult," I ought, to prevent misunderstanding, to say at once that I use it in the popular and not in a climber's sense. Some travellers call any path where you cannot ride difficult; in the Alpine Club we restrict the term to places where an active man is in danger of tumbling. There are none such on the Jonsong La, though there is plenty of scrambling over rough ground, and there may be danger at times from falling stones or bad weather. Allowing for the difference of scale in the two ranges, the Alpine pass to which it may most fairly be compared is the well-known Strahleck, between Grindelwald and the Grimsel.

It is to this journey of Rinsing, to which I called attention in the *Alpine Journal* at the time, that, as Colonel Gore tells me, Indian geographers and cartographers have been indebted for such knowledge as they possess of the north-western slope of Kangchenjunga. The information Rinsing brought back was embodied in a sketch-map, a copy of which Colonel Gore has kindly sent me.*

As far as the general trend of the valleys is concerned, Rinsing's work, while not free from error, is in the main fairly satisfactory. He did not carry his map, nor can I carry my commendation much further. Rinsing, by the kind order of his superiors, accompanied us into what, in a memorial he presented to me before we parted, he poetically described as "the jaws of Death." I had therefore full opportunity of observing his method. Sitting in a snug tent and filling in subjective details was much more to his taste than scrambling over rough moraines with a plane-table. As travellers, as observers in the ordinary sense of the word, both he and Chandra Das doubtless deserve our

* This and the other official sheets are in the R.G.S.'s collection, and were exhibited when the paper was read before the Society.

esteem; their narratives are full of local information, and often extremely entertaining. For example, nothing can be more graphic than Chandra Das's descriptions of how he suffered from the rarity of the air, how he was carried uphill on his comrade's back with his eyes shut, how he "embarked on a slide, met with slippery ice, and consequently got pains on the back, caused by friction." But it would, in my opinion, be a mistake to regard them as scientific cartographers in the technical sense of the term.

To get round Kangchenjunga was not the only object I set before me. I hoped also to obtain, what up to the present time the Indian Survey has been too fully engaged elsewhere to give us, some accurate idea of the glacial features of the group, some material for comparing them with those of the Alps and the Caucasus. I hoped to be able to ascertain the number and length of the main ice-streams, the amount of ground covered by snow and ice, and any peculiarities which might distinguish the glaciers from those of more temperate regions.

I am now in a position to give a fairly complete estimate of the glaciers of Kangchenjunga. Four glaciers radiate from the peak, pointing roughly to the north-east, south-east, north-west, and south-west. These are the Zemu Glacier, 18 miles long, and the Talung Glacier, both draining to the Teesta; the Kangchen Glacier, 15 miles long, and Yalung Glacier, both draining to the Arun and the Kosi. The forked spurs that protrude south and west from Kangchenjunga, dominated respectively by Kabru and Jannu, enclose in the first case the Alukthang Glaciers, united not long ago in a single stream, and now divided by little more than their moraines, and the southern glaciers of Kabru, which fall into a separate glen; in the second case, three considerable ice-streams, one of which almost meets the Kangchen Glacier at its lower extremity, the second builds across the valley, out of the rockfalls of the tremendous cliffs of Jannu which encompass its source, a remarkable wall of moraine stuff, similar to those of the Allalein, or the Brenva in the Alps, while a third fills a glen, the stream from which joins the Kangchen torrent at Khunza.

I must not omit, though I was unable personally to explore them, the minor but considerable ice-streams that are seen from Darjiling and Gantok to flow from the southern slopes of Simvoo and Siniolchum or those surrounding the base of Narsing and Pundim, which, in default of any particulars from Mr. White, have been laid down from our sketches and photographs with a certain vagueness.

The ice at the base of the Zemu and Alukthang Glaciers descends to 13,000 feet; this is about its lowest level in Sikhim. Taking into account secondary glaciers, the amount of square miles covered by snow and ice in the group, accepting the 24,340 peak close to the Jonsong La as its northern limit, may be reckoned roughly at 180 square miles.

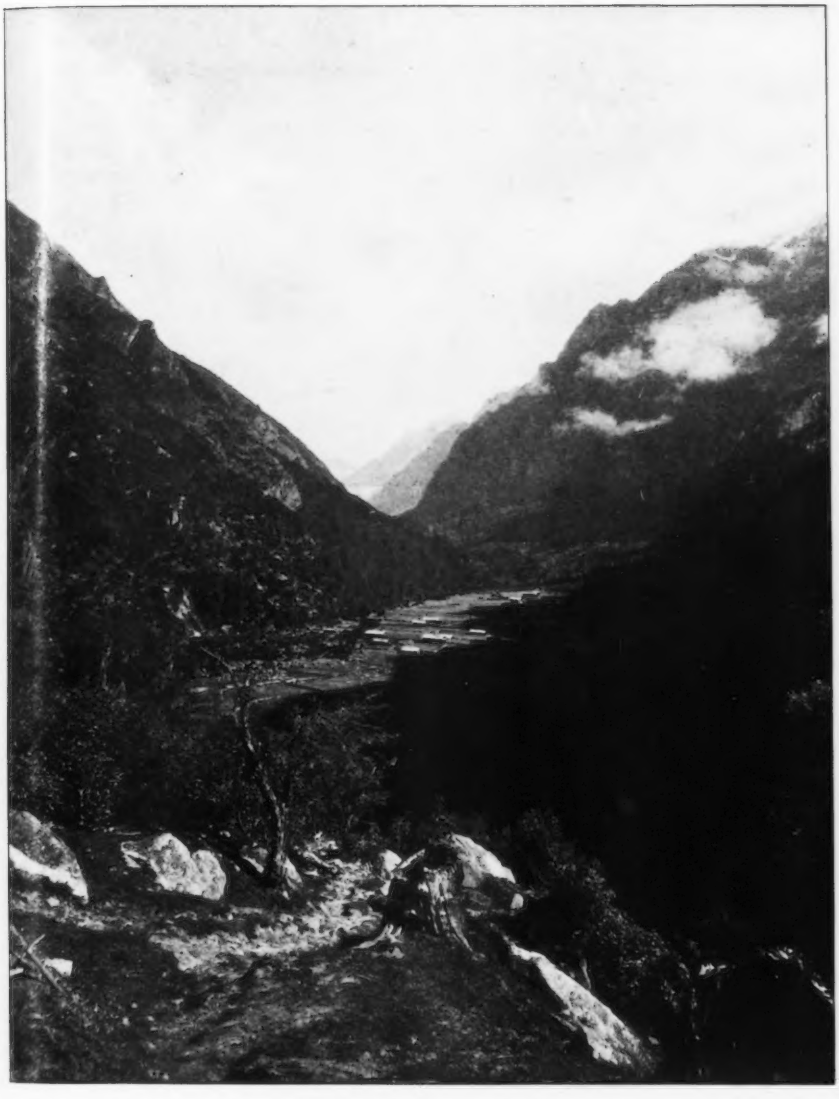
Next a few words as to the most notable peculiarities of Sikhim

glaciers. To begin at the top, at their sources. We ascertained by means of glasses that the transformation of snow into something like glacier ice takes place within a few hundred feet of the final ridge of Kangchenjunga. *Névé* is found there, as in similar positions on the Jungfrau in the Swiss Alps. In these conditions it may appear strange that we saw or heard so few avalanches. Probably they mostly fall in the heats of summer.

In the upper icefalls the ice is apt to assume strange forms. I may best describe them by comparing them to the earth pillars found in certain friable soils: the glacier is converted, not into Alpine seracs—towers and ridges severed from one another by profound clefts—but into clusters of ice-cones, repeating the same form monotonously. The main glacier is apt to be terribly uneven, a confused labyrinth of huge mounds, stony ridges, and hollows filled with yellow pools, but it is seldom much crevassed. We never had occasion for a rope. Progress is constantly delayed, but seldom stopped. Owing to the steepness of the range, the amount of rock surface exposed, and the rapid disintegration caused by extremes of heat and cold, the trunk ice-streams are buried and hidden under piles of rubbish. Materials enough to build a city are brought down by the gigantic sledge which Nature employs in her mountain architecture. The torrents that flow from these vast glaciers are not, however, in proportion to their size.

The features just enumerated may, I doubt not, find an explanation in the local climate. Intense cold follows on great sun-heat; an enormous deposition of moisture, whether in rain or snow, takes place during many months of the year. Ice under such conditions becomes more plastic or viscous, or whatever term the glacialist of to-day may prefer, it cracks less and is more malleable, it loses more by evaporation. The sun, except in winter, as we learnt to our cost, soon spoils the night's crust that helps the traveller on Alpine snowfields. Rocks, again, are quickly split by alternate heat and frost, and the granite cliffs send down ceaselessly their tribute to the ice-sledge as it glides beneath them. With regard to traces of an ancient extension of the ice, it must be obvious to any trained eye that it has been in recent geological times a good deal lower than it is now. Glacial action may be traced for two or three miles below the present end of the Zemu Glacier. Vegetation and denudation make it difficult to trace it further, but I suspect in some remote age the ice reached Lachen. Throughout Lhonak the surface of the earth shows signs of glacial shrinkage. Lhonak is a region where the conservative action of ice is admirably illustrated in the comparatively shallow valleys and smooth hillsides.*

* I may refer to my paper on "The Conservative Action of Ice" in the *Geographical Proceedings*, vol. x. p. 799. I do so with more confidence since several eminent geologists, among them Prof. Garwood, have expressed their general agreement with my argument.



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KHUNZA IN NEPAL.
Looking North.

As you are probably aware, a European Association has been formed, of which I have the honour to be the member for Great Britain, to carry on the work initiated by the Alpine Club of obtaining measurements, from all parts of the world, of glacial oscillations, which are not without considerable importance as indications of climatic variations. I have reason to hope that our records may be extended to India; but there is difficulty in finding ice-streams near enough to permanent stations to be systematically visited, and there have been in the past artificial difficulties arising from the extreme complexity of the departmental system at Calcutta, difficulties which I think may be overcome by the good-will of the present Viceroy, Lord Curzon, towards all reasonable scientific proposals.

I may be expected to add something to the discussion on mountain sickness that continues, without much sensible advance, to fill pages and even volumes in mountaineering literature. I could easily occupy with it the rest of the evening. For *quot homines, tot sententiæ*. No two persons feel mountain sickness in exactly the same way, though mountain sickness, like sea sickness, is a painful reality to the majority of mankind. My party were affected most unequally; Mr. Dover, the Road Inspector, never appreciably suffered—he even gained weight on our tour; Mr. Garwood was for forty-eight hours practically incapacitated, though sunheat on new snow had probably much to do with his symptoms. Most of us, Englishmen and natives, felt, in various degrees, our powers diminished; we experienced an indisposition to exertion, bodily or mental—what Stevenson, writing of the climate of Davos, calls "an underlying languor of the body"—a slackening of pace and increased breathlessness in going uphill. We suffered most on first reaching an elevation of 15,000 to 16,000 feet; there was no increase in our symptoms on rising over 20,000 feet. Some of our men, particularly the Ghoorkhas, walked steadily at that height. I was myself never so uncomfortable as I once was on Mont Blanc. It used to be said no one could climb the last slopes of Mont Blanc without frequent halts. The last time I climbed the mountain, I walked straight up the last 1500 feet from the Vallot hut. In the Himalaya I was able to walk, at the end of our tour, from 13,000 to 16,000 feet without a halt. We and our Alpine guide were sometimes quite exhausted by the struggle in soft snow; but soft snow is killing anywhere. I have seen Melchior Anderegg, one of the greatest of Alpine guides, dead-beat for the moment, at a height of 6000 feet, by tracking a path over the Great Scheideck in winter. I am ready to commit myself to an opinion. Training and habit and attention to diet will not do away with mountain sickness, but they will go on reducing its area and its virulence. We have practically driven the enemy up 8000 feet in the last fifty years. Our successors will, I believe, drive it up the remaining 5000 feet in the next fifty. Kangchenjunga and its still loftier

Nepalese neighbour will one day have a flag on their summits. This is my prophecy. Let who will contradict it. Time will show.

I turn next to cartography, to the maps that include the Kangchenjunga group. Sir J. Hooker's, the first, is based to a large extent on his own observations. It is in the main a route-map—an admirable route-map indicating the local topography of the parts he visited with approximate accuracy, but, unfortunately, on a very small scale. It does not attempt to grapple with the glacial features of the Kangchenjunga group, which he did not closely explore. Moreover, some of the peaks had not at that time found their true positions.

Next comes what I may call the mother-map—the official transfrontier survey, long labelled "Confidential," on a scale of 2 miles to the inch. On this the great peaks have been placed from distant trigonometrical observations; while a number of the minor summits north of Kangchenjunga appear to have been located and measured by the late Captain Harman and Mr. Robert, who established stations above the lower part of the Lhonak valley. In the portions of Sikhim not penetrated by the survey party, minor spurs and features are indicated with much but often purely conventional detail.* The valleys west of the Kang La are entirely misrepresented on the authority of Mr. Robert (a copy of whose sketch I have before me). He brings the Yalung valley up within a mile and a half of the Kang La! Hooker's little map is far nearer nature here. The rest of the Nepalese slope is left blank. The sole hint of glaciers is contained in the word "moraine" printed across the valley filled by the lower part of the Zemu Glacier.

I desire to guard myself at the outset against any suggestion that in this plain statement of facts I am attacking the Indian Survey. To do so would be a poor return on my part for the aid and courtesy I have received from its present head, Colonel Gore. Moreover, I do not think the facts cited are in any way a discredit to his predecessors. However interesting to the physical geographer, glaciers have no, or at most a very indirect, political, administrative, or commercial importance, and, until a comparatively recent date, they were ignored in most European surveys. The Indian Survey has had its hands constantly full of work urgently needed by the Government, which had to be done first. Nevertheless it has sent surveying parties into the mountains of Kumaon and the Karakoram. The glaciers of Sikhim have so far had to wait. Its tea gardens had a prior claim. Recently, however, there have been attempts to indicate the glaciers round Kangchenjunga on the new editions of official maps.

If you look at these photographs of recent reproductions and reductions of the Transfrontier Map, you will see that the surveyors have

* Sir T. Holdich has informed me that the cartographers were authorized to supply conventional detail where no authentic detail was forthcoming.

been making some endeavour to introduce snow and ice. You may notice a few worms crawling about the heads of valleys. These represent glaciers, to which they bear the same relation that the caterpillars of our school maps do to mountain ranges. They do not exhibit the sources of the ice-streams or their connection with the *névés*, and they stop short miles above the snouts of the existing glaciers. This apparent want of method is, however, I think, not without a purpose. The ordinary conception of a glacier, in the mind of the oriental cartographer, seems to be *bare ice*. The *névé* reservoirs that feed the stream and the moraine-cloaked tongue that descends into the valley are ignored. It is obvious that such representations can be of little value to the physical geographer.*

It has been from time to time the privilege of mountaineers, such as our late colleague on the Council, Mr. John Ball, and Mr. Wm. Mathews, in the Piedmontese Alps, Mr. Adams Reilly in the Pennine Alps, and more recent travellers in the Caucasus, to criticize and make suggestions, or to furnish material, which have led to marked improvements in the Government Surveys of the countries concerned. I should fail in my duty, did I not endeavour humbly to follow in the footsteps of earlier mountaineers, by suggesting by precept, and, as far as my means allow, by example, the principle on which a glacier map of Sikhim, which will be of value to the physical geographer, may be constructed. I therefore venture to offer, by no means as a perfect or a final map (a complex glacial labyrinth like that of Kangchenjunga is not mapped in a month), but as, at least, a specimen of the right method to delineate glaciers,

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* The official publications and manuscripts I have had before me are the Transfrontier map (2 miles to inch), 1885; a revision (4 miles to inch), 1889; North-eastern Transfrontier map (8 miles to inch), 1889; Skeleton map of Sikhim (4 miles to inch), three editions, 1892, 1894, 1900; Colonel Tanner's map of Sikhim, 1866; manuscript sketches of Rinsing, 1884–85 (Nepalese slope of Kangchenjunga), and Robert, 1881–83 (district round Kang La). The heights given on these maps appear to be divisible into three classes—

1. Peaks included in the Great Trigonometrical Survey of India, the heights assigned to which have never varied.

2. Lesser summits, particularly those in the chain north of Kangchenjunga, trigonometrically measured by the Sikhim Survey party. Many of these altitudes have been revised, some increased, others diminished, not, Colonel Gore informs me, as the result of fresh observations, but after a recalculation in the office.

3. Miscellaneous heights of passes and places, probably derived from various sources, pundits' or travellers' notes. I give examples of some of the more notable variations: Yumptso La; Transfrontier map, 17,040; Skeleton map, 15,800. Tangchung La; Revised Transfrontier, 17,100; Skeleton map, 1896, 17,840; 1900, 17,340 (misprint?). Thé La; Revised Transfrontier, 17,430; Skeleton, 1892 and 1894, 17,810; ditto, 1900, 16,575. Tebli; Skeleton, 1892, 15,600; ditto, 1900, 14,500. And last our Jonsong La; Sikhim Gazetter, 1894, 22,300; Revised Transfrontier, 22,000; Skeleton map, 1894, 22,000; Colonel Tanner, 1886, 19,000 to 20,000; Rinsing, 21,500. In Mr. Garwood's map I have inserted the official triangulations in thick type, Mr. Garwood's heights in thin sloping type, and a few heights from miscellaneous sources in brackets.

Mr. Garwood's map. I believe it attains to very fair accuracy of detail in the glacier basins, which we ourselves explored in fine weather. Elsewhere it at least indicates approximately the extent of the ground covered by snow and ice. According to my experience, the best spur to further action is to give people something to criticize. This, at any rate, we have done.

Descending below the snow-level and leaving the glaciers, I have still one or two serious, or scientific, matters to which I ought to invite my readers' attention.

There can, I think, be no doubt that the situation of Darjiling is very far from the best possible for a health resort in this region. It was chosen partly at least for political reasons. It stands on the screen of foothills—it is true, on the north or less exposed side of it, having therefore a smaller rainfall than Kursiong, on the south side, but still on the screen that receives the first fury of the rainstorms that sweep up from the Bay of Bengal. This exceptional exposure was demonstrated forcibly in the great storm (of which more hereafter) of September, 1899. The injury done round Darjiling itself was in part caused by the reckless clearing of forest, and consequent exposure of soft slopes at high angles, caused by the spread of tea plantations. But it was the streams fed by the outer foothills, rather than those from the interior ranges, that swept away their bridges and destroyed villages. The observant visitor will hardly fail to notice in the character of the forests a proof that the worst of the rains strike the foothills and surge up the great gap of the Teesta. Farther west, towards and beyond the Nepalese frontier, the vegetation is less rampant; the valleys at the western base of Kangchenjunga are dry and open compared to the glens of the tributaries of the Teesta. The Vale of Kambachen is not more densely wooded than that of Lauterbrunnen, while the Zemu forests are almost impenetrable.

An ideal summer sanatorium would probably be found in the Chumbi valley, which, for reasons best known to politicians, we did not annex fifteen years ago when we had the opportunity of doing so as a penalty for the Tibetan invasion of Sikhim. But, short of this, there are spots—Lachen, for instance, or the downs at the head of the Singalila ridge—where some kind of health station, which would bear to Darjiling—in climate, at least—the relation the Engadine bears to Monte Generoso, may in the future be established. Difficulty of transport will be alleged, but, looking to the development in the last ten years of mountain railways, these difficulties, though actual, will not, I believe, prove permanent ones. This, however, is a matter for the future, perhaps not a very near future. For the present, one of the great wants of Independent Sikhim is horse-roads. In past years pains and money have been expended on patching up the fantastically circuitous and precipitous native tracks which might, I believe, more wisely have been used in

constructing one or two trunk horse-roads, on lines laid down by experts. I understand the authorization of the Government has been given to steps in this direction, and that some steps have already been taken. My companion in Sikhim—Mr. Dover, now the Road Inspector—writes to me of bridges built, bungalows erected or restored, Lachen and Lachung—the villages in the Teesta valley that correspond to Saas and Zermatt—opened to travellers. The Indian Government already publishes a list of tours and resting-places; it has taken, therefore, the initial steps towards creating a mountain playground for Calcutta. A few more efforts in the same direction, and these comparatively slight efforts, might produce great results. Some 8 miles of new path and a couple of bridges would link Pamionchi to Jongri and the southern glaciers of Kangchenjunga, and enable a horse-party to go up this way and return by the Singalila ridge. Some 10 miles of cutting through the forest would open the Zemu Glacier; a stone bungalow on the plan of an Alpine "Clubhut" might easily be built at the Green Lake at the north-eastern base of Kangchenjunga, at a height of 16,000 feet. The tour of Kangchenjunga must, however, I fear, for years to come be a serious matter, apart from political difficulties, since it means coolies, and coolies are—well, they represent time and money. We can hardly ask the Indian Government to imitate the Canadian, and bring out Alpine guides to aid explorers. A climbing party with such aid might, I think, make the tour of Kangchenjunga in a fortnight from Jongri, or even shorter time, could they force the 19,300 feet gap at the eastern base of the mountain. I say nothing here of the ascent of Kangchenjunga. That is an esoteric matter I reserve for the Alpine Club. Nor need I attempt to add anything on the Flora; we have Sir Joseph Hooker's volumes. I have already alluded to the strange imitative forms of the butterflies. Mr. Garwood, regardless of leech-bites, made a large collection of butterflies and beetles; and Signor E. Sella brought home Alpine plants, which he is endeavouring to naturalize at his home in Piedmont.

I will not detain you any longer with general reflections, but attempt to give you a summary of our journey.

My party was composed as follows: Mr. Garwood and myself, Signor Vittorio Sella, the well-known mountain photographer, and his brother. An Alpine guide, A. Maquignaz of Val Tournanche, also came out with us from Europe. The great snowstorm prevented us from making full use of his climbing powers. To this party were further added, by the kind consent of the Indian authorities, Mr. Dover, now Road Inspector in Sikhim, whose services were invaluable; and Rinsing, the native surveyor, I have already mentioned, who made himself very useful in many ways throughout the journey.

Our camp-followers consisted of a horde of coolies, who diminished by dismissal or desertion from about eighty at starting to thirty or

forty at the end. I hope this statement will not make you think we campaigned with heavy stoves and pianofortes. Our tents were 7 feet square, and of the lightest possible make; our cooking-stoves would each have gone inside a silk hat. As it proved, we had only just enough provisions to carry us through the wilderness. A Sikhim coolie's load is half composed of his own rations of rice, hence the necessity of numbers. We had also an escort of half a dozen Sikhim military police with guns and bayonets, who looked after the coolies, and would have protected us from any of the Tibetan robbers who are said to infest the no-man's-land of Lhonak.

After consultation with the few authorities on the matter, I came to the conclusion that my first business was to get our party to a spot reached by Mr. White and Mr. Hofmann, the Calcutta photographer, near the head of the great Zemu Glacier, east of Kangchenjunga. Maps show a gap of 21,000 feet in the range beyond, the chain dividing Sikhim and Nepal, only 4 miles north of the peak of Kangchenjunga. Should this gap prove practicable for coolies, it would save us the circuitous march to the north, necessary in order to reach Rinsing's Jonsong La, which is marked on maps, whether on his authority or Captain Harman's I know not, alternately as 21,500 or 22,000 feet.

Leaving the new Teesta valley horse-track at Lachen (8800 feet), a village the inhabitants of which are Tibetan in type and manners, we hacked our way, by the aid of our Ghoorkha pioneers, through the rhododendron forests of the glen that checked Sir J. Hooker, and in five days—after the track had been opened it proved a two days' walk for a messenger—we reached a wild goats' pasture and a small green tarn at a height of over 15,000 feet, some 10 miles above the foot of the glacier and within four hours' walk of the extreme source of the ice under the gigantic cliffs of Kangchenjunga. There we established a light camp, leaving our heavier tent and the bulk of our followers some miles lower down.

Next day, full of hope, and in apparently improving weather, I set out with our Alpine guide to reconnoitre. We found our way over rough ice and rugged but flowery hillsides to the very base of the Kangchenjunga precipices. I was within at most, I think, three hours' easy walk of the 19,300-feet gap (it might properly be called the Zemu gap), which, however formidable from the south, is perfectly easy of access from this side. I resolved to move our camp up to the last *terra firma* where there was enough juniper for a night or two's fires. Thence we could, I believe, in the existing conditions, easily have climbed Simvoo, officially known as Siimvovonchim (22,300 feet), and got a full view of the east side of our proposed pass to Nepal, the crest of which we had already seen in profile against the sky from the lower glacier. It lies at the head of a large tributary glacier flowing from the west-north-west, which we had crossed half an hour above our camp. *L'homme*

propose; the demons of Kangchenjunga disposed. The sky, which had been deep blue, turned pale, then grey, then almost yellow; thin, ugly vapours gathered upon the great crest. The sun grew sickly, and was surrounded by a lurid ring, coloured from time to time by strange iridescences. The air was perfectly still and very close and warm. Recognizing all, and more than all, the usual signs of bad weather, we hastened to return to camp. When halfway we saw dark mists racing up the valley, and were met by a keen blast. We raced too, and got off the moraine as the first flakes of snow fell. In a few moments the storm was on us, everything was blotted out, and we were guided into camp by the shouts of our Darjiling Sirdar, who had hurried out in search of us. I tumbled into my tent and panted speechlessly for some minutes. I had forgotten that it is inexpedient to run a quarter of a mile, even downhill, when at the level of the top of Mont Blanc.

The history of the next twenty-four hours was a blank—a white page in our diaries. The snow fell heavily all Saturday night and Sunday. In the evening some coolies came up from our lower camp and told us that four men we had sent down the evening before had not turned up, and must be lost. The Sellas proposed that a relief party should set out at once in the darkness. I discouraged such action, feeling convinced that the men, following the fashion of the country, had taken shelter under rocks. I proved to be right.

At dawn on Monday it was, after forty-two hours' fall, snowing as hard as ever. We measured exactly a metre (3 feet 3 inches) round our camp where it had not drifted. The snow had to be cleared off our tent-roofs every half-hour to prevent a collapse. There seemed no reason why the storm should stop, and every reason that we should go. One of the smaller tents was completely buried, and the few coolies with us were naturally frightened and impatient. Even our Alpine guide began to babble of avalanches.

We shall none of us forget that walk to the base camp. We started in a dense fog. At first the snow was so deep that it seemed hardly possible to move more than a few yards. Unladen men went ahead to beat a track; we and the light luggage followed. The work was very laborious, and our progress of the slowest. Sending constantly a fresh man to the front, we floundered along, sinking deeply at every step, and glad when we did not tumble up to our waists in some hidden pitfall. Of a sudden the veil was rent before our eyes, and, incredibly vast and strangely transfigured, white and shining from base to summit, the giants of the Himalaya looked down on the train of miserable ants crawling about their feet. The hot glare reflected from the snow and enhanced by the shining particles of mist was terrific; our faces were scorched, and my lips so badly blistered that, as they were subsequently touched by frost, it was six weeks

before I could eat a meal in comfort. This was a unique experience. We never suffered again from heat or sunburn during our tour.

It was not till long afterwards that we learnt that this calamitous storm, which changed the character if it failed to defeat the main purpose of our journey, was no ordinary incident of Himalayan travel, but the phenomenal outburst which, by the havoc it wrought in and about Darjiling, acquired a world-wide notoriety. Nor, happily, were we aware that some newsmonger at Darjiling had excited our friends in England, by reporting by telegram that there was every reason to believe that we were buried under avalanches which from a distance of 40 miles he had watched falling on the southern face of Kangchenjunga, the opposite face to that on which we were! The modern newssheet, which makes "the moving accident its trade," is a pest to travellers, except, perhaps, those who travel to be boomed.

Next morning we woke to "set fair." The world was all white; the smoke of our camp-fires alone sullied the blue heavens. The fine weather which, with one break of forty-eight hours, was to last for the remainder of our journey had set in.

But the conditions were altogether changed. The Easy had become Difficult; the snow-level had been lowered 4000 feet. We had hoped to make some high ascent, to force a pass into Nepal from the head of the Zemu Glacier. All such projects had now to be abandoned; to get round Kangchenjunga somehow was all we could hope, or reasonably attempt. Our plan had to be modified to suit the altered conditions—to speak more exactly, the lowered snow-level—which we were henceforth to find at 14,000 to 15,000, instead of 18,000 to 19,000 feet. My companions spent two days in plane-tabling and photographing on the Zemu Glacier. We gazed with ceaseless delight on the peak immediately opposite our camp—Siniolchum, 22,750 feet—the most beautiful snow mountain I have ever seen, perhaps the most beautiful in the world. Its icy sides are exquisitely fluted by avalanches; the snow upon its edges is blown up into fantastic fringes, so thin as to be transparent to the Indian sunshine.

Siniolchum stands with reference to Kangchenjunga and the Zemu Glacier much as the Aletschhorn does to the Jungfrau and the Aletsch Glacier, that is, on the flank of the lower part of the glacier, while Kangchenjunga rises above its head. On the fourth day after the storm we started to cross two passes, the Thangchung La and the Thé La, over which runs a native yak-track, used for the transport of timber and salt between Tibet and Sikhim. In an ordinary year these passes are as easy and not more laborious than the Wengern Alp and Great Scheideck in summer. They now exactly resembled those passes as I once found them in January—that is, they were snow-grinds. The loose snow on the descent was very trying to the coolies, who made many involuntary glissades. Preferring to black their faces, or, in the case of the Lepchas,

to improvise veils with their long locks, rather than to use the spectacles with which I had provided them, they suffered also from snow-blindness.

In three days we reached the lower end of Lhonak, and in two more its head. This district, though on the Indian side of the watershed—in fact, feeding the main source of the Teesta—displays all the characteristics of Tibetan landscape. The shapes of the hills and the foreground are those of an ice-modelled region, like the duller parts of the Highlands. The 21,000 to 24,000 feet peaks which overlook the valley are on much the same scale as those of the Upper Engadine; they rise from 5000 to 7000 feet above their bases. Huge moraines mark the former extent and limits of vanished or diminished glaciers. There is not a tree to be seen; even the grass is scanty; the slopes are brown and yellow, the flats grey and sandy, and strewn with sky-reflecting pools, or flecked with patches of light-blue gentians. The only signs of human habitation from one end of the region to the other are two or three low walls which afford summer shelter to a few Tibetan shepherds and their yaks. We saw nothing of the shepherd-robbers, who, according to Chandra Das, "have charge of the passes," and in return for their services, are authorized to rob all travellers who venture to cross them. If they still exist, they had all gone north to their homes; but we met and slew a lonely yak. How it came to be there was a mystery. Some said it had been left as a peace-offering to the mountain demons, a scapeyak; others, that it had been driven out of the herd by a stronger bull—a broken horn gave some countenance to the latter hypothesis.

From the head of the valley I and Erminio Sella, led by Rinsing, climbed to a ridge which Rinsing declared to be the Chortenima La. It was not that pass, which, as we subsequently ascertained, lies farther west, but part of a glacier-clad range dividing us from another source of the Teesta. The gap, which we reached by a rough scramble, was between 18,000 and 19,000 feet in height, and commanded a superb view, of which my companion obtained panoramic photographs. Southwards, over a wilderness of fresh snow, we saw the Kangchenjunga group, and our eyes, ranging through west and north to north-east, followed the chain that connects it with the Tibetan plateau. Above the Lhonak glaciers the granite apparently trends away westwards; the range north of Lhonak is limestone.

Three gaps in the ridge encompassing the head of the Lhonak valley were conspicuous. That on our left, between the peaks marked 24,340 and 22,700 feet on official maps, was obviously, though long and lofty, under ordinary conditions free from anything a mountaineer calls difficulty. A steep, but not excessively steep, snow-screen connected the two peaks, while the hollow beneath was filled by smooth glaciers. The ground below the ice is usually bare broken slopes; it was now one vast sheet of snow spread over long hillsides.

To accomplish this most laborious ascent, we took, or rather our coolies took, two and a half days. The distance was considerable, but the actual height to be climbed not over 5000 feet.

Our difficulty was entirely caused by the fresh snow. We waded and floundered through the hours of light with much waste of precious time at the beginning of each day, the result of the incorrigible habit of the coolies of waiting till the sun strikes their tents before they will uncurl and cook their indispensable morning meal.

In this way they lost, of course, any chance of finding the snow hard. The worst part of the climb was the lowest, where we tumbled about among the hidden pitfalls of loose moraines, or waded up a little stream, which we found preferable to wading in the deep snow on its banks. As we mounted, the views grew wider and more majestic: we gazed out to Chomiomo and Chumalari, and on a range of unknown peaks between and beyond them. We enjoyed superb sunsets and mystical afterglows, the brilliant colouring of which was enhanced by contrast with the white fields of snow which encompassed us on every side. The final ascent to the pass gave us no particular trouble; the last climb was up a bank of bare loose rock. The actual crest proved a cornice, overhanging an incipient crevasse. We broke a hole through the snow-wave and stood on the top, for which our measurement gives the height of 20,200 feet.

Our first feeling was one of disappointment. Rinsing had been promising us a view over Nepal and the valley of the Arun to "Mount Everest." A ridge a mile off, very little higher than our pass, shut out that view. Our next feeling was dismay, when Rinsing, a comical figure, burnt red as a turkey-cock, and shaking his pigtail mournfully, announced that we were not on the right pass. I admonished him sternly to keep his opinion to himself, for if our coolies once heard it, how should we induce them to persevere?

What we saw was a broad névé basin some 500 feet below us, from which a glacier stretched away down a narrowing trench between rocky walls until it was closed, apparently hermetically sealed, by the huge bulk of Kangchenjunga. To the right, the blunt head of Jannu, oddly like that of the Matterhorn from Breil, rose for the first time over the nearer icy ridges.

From what I had seen three days before, I felt certain that the basin below us did not drain into the Teesta as Rinsing now asserted. Our plane-table, directed on Kanchenjunga and the great peaks, showed that we were approximately in the position assigned to the Jonsong La on the map. After some discussion, we determined to go on; but the lingering of the coolies forced us to camp on the ice again before we had got far. The next day we rambled over the frozen hillocks and down the sloppy dales of the glacier. The afternoon we spent in traversing a rocky slope, in the gullies of which stones rattled dangerously at intervals. We slept

KANBACHEN IN NEPAL,
with Jannu and the dyke of the Jannu Glacier.

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another night, our fifth, on the ice, for on its banks there was nowhere to pitch a tent. Tributaries poured in on all sides their broad billowy icefalls. Kangchenjunga rose up ever nearer and nobler in front. At last, where our glacier plunged down to the meeting-place of ice-rivers under the craggy buttresses of the great mountain, Rinsing, with unexpected confidence, struck up a steep moraine on our right. In a quarter of an hour we were on turf, a pleasant terrace sloping down parallel to and far above the ice. Just at the corner over the junction of five glaciers whose united flood flowed west, or at right angles to our previous course, we pitched our tents on a platform where the snow lay only in patches, and there was dwarf juniper for firewood. Our coolies shouted for joy as they threw off their burdens on the dry turf.

We were safe in Nepal, at the head of the valley of the Kangchen, looking at a sight never before seen by European eyes—the north-western face of Kangchenjunga, not a sheer cliff, like the three other aspects of the peak, but a superb pile of rock buttresses, terraces of snow, and staircases of ice, through whose labyrinthine complexities the future conquerors of the great mountain will have to find the least hazardous way to the summit.

The best part of the next day we waited for stragglers, and gazed at the stupendous scenery. Some of our coolies were still lingering in the rear, and did not catch us up for forty-eight hours, when they reported that they had lost one of their number, who had preferred to remain behind and die to walking any further. We could not make them share, or even understand, our horror at their desertion of their comrade. They simply said, "He did not wish to live; he had a right to do as he pleased." They were, of course, Buddhists.

Many of the coolies were a good deal the worse for the snow; there were among them several slight cases of frostbite and of sore eyes; for to make them use the boots and spectacles provided was a hard matter. But there were no very bad cases, and when Mr. Dover met some of our men twelve months afterwards, they expressed their readiness to go again. I ought, perhaps, to mention that they were volunteers.

We had still two days' march, of which we made three, in order to reach Hooker's old tracks. But it was all downhill. For several hours we trod on meadows of edelweiss beside the huge boulder-burdened glacier. Long green alleys beside the glaciers are a feature of Sikhim, and a great convenience to travellers. Possibly they are preserved by torrents issuing from side glens, which by constantly washing away the lateral moraines restrain the main glaciers from pressing the hillsides. We passed a gap on our right, which presumably leads up to the Chabok La. Here were some at the time deserted shepherds' huts, the first human dwellings we had seen since leaving Lachen twenty-one days before. On our left a fine glacier came straight down from the western-most of the five peaks of Kangchenjunga, and almost joined that we

had descended. It issued from between two icy ridges. I never saw such perpendicular mountain architecture as that of the spur that overhangs the valley on the left at this point. Kambachen is a group of stone huts, such as may be seen anywhere in the Italian Alps, but is rendered picturesque by numerous chortens and prayer-flags. It was deserted when we passed. It lies immediately under Jannu, which presented its astounding precipices in the morning light.

The next reach of the valley is very beautiful. Forest begins below the Jannu Glacier, a forest of junipers, firs, and some deciduous trees. High cliffs rise on either hand, and the snow-peaks peer above them. But that the walls are granite, not limestone, the scenery might be compared with that of the Lauterbrunnen valley.

At Khunza, a large and populous village and monastery, we came on human beings, and met Sir J. Hooker's track. Considering that only one Englishman had ever visited Khunza, and that half a century before, we excited very little curiosity. The people cross to Darjiling to sell butterflies, so that Europeans were no novelty to them. They seemed well-to-do; large herds of yak, said to be "State property," were pasturing on the meadows, and poultry and potatoes were fairly abundant.* Their cottages were wood-built in the Swiss style.

We next traversed three passes of about 15,000 feet, on the spur of Jannu, described by Hooker as the Choonjerma. From one of these we had a noble view on one side over Nepal; on the other, of Jannu and its satellites. The blue vault was ringed with wintry snows; round us the upper slopes and valleys were rich in the faded reds and browns of autumn; below these spread the eternal green of the zone of tropical summer; and beyond, again, we could see the pale shimmer of the plains of Bengal. But the centre of the scene (to us at any rate) was the Lapchikang group, with the highest measured peak in the world, the Mount Everest of the survey, the Chomokankar of Major Waddell and the Pundits,† rising behind the splendid dome of Makalu. Owing to our being so far north, it appeared on the northern instead of the southern flank of Makalu, where it is seen from stations on the Singalila ridge. Rinsing consequently could not recognize it! In shape it is not imposing; it looks an "easy mountain." Its outline reminded me of that of the Dôme and Aiguille du Goûter, Mont Blanc being suppressed. Behind it rose a gigantic rock-peak which is invisible from more southern stations. I regret that I cannot throw any fresh light on the question whether there are—as several native explorers and Mr. Graham have suggested—higher summits north of Everest. We did not recognize

* See 'Narrative of a Journey to Lhasa,' by Sarat Chandra Das (Calcutta, 1885), for a detailed description of Khunza.

† See Major Waddell's very instructive and entertaining volume, 'Among the Himalayas' (London, 1899).

any, but we were 3000 feet lower than the Kang La peak, whence Mr. Graham thought he saw them.

From this point we diverged again from Sir J. Hooker's track. Clouds and a snowfall, coupled with failing provisions, prevented any exploration of the glaciers between Junnoo and Kabru, and hindered us from climbing the Kang La peak while crossing the pass of the same name.

We arrived at Jongri (13,100 feet), a yak pasturage with two stone huts, the future Riffel Alp of Sikhim, in driving sleet. Despite broken bridges, Mr. Earle's kindness had sent up our letters and fresh stores by the Singalila route. The fine weather soon returned, but it became much colder. The smaller streams, down to 12,000 feet, remained frozen all day. We climbed Kabur, the local Riffelhorn, 100 feet higher than Mont Blanc. I believe that had we gone first to Jongri, and not encountered the great snowstorm, we might have got up Kabru. It is obviously the most accessible of the great peaks. We tramped north, a three days' march there and back, to the Giucha La, a 16,400-feet pass under Pandim, which has been visited by a certain number of tourists from Darjiling.

We enjoyed sunrises and sunsets, the rose of dawn on Kangchenjunga, the last flush of evening on Kabru, radiant noons and still more rare and radiant full moons; we watched the clouds rising in pillars, like our childhood's friends the genii of the 'Arabian Nights,' from the depths of the valleys; beyond the varied greens of the forest foreground we saw the marvellous sapphire waves of the distant foothills; we recognized in the golden haze of the far-away plains the windings of the silver ribbon of the Teesta, 80 miles off.

At last we turned our backs on the snows. We plunged down 6000 feet in a few hours, through a wild tangle of rhododendrons and bamboos; we spent a long afternoon in tripping delicately across the face of cliffs on frail and ruinous bamboo balconies, or climbing up and down rock staircases and ladders of roots. Such is an aboriginal path, neither difficult nor dangerous in the climber's sense of those words, but singularly vexatious to a weary traveller.* We accomplished a two days' journey in one, and, in the gloaming, we emerged from the forest, and, leaving behind us the screeches of the green parrots and the chatter of the monkeys, who had seemed to mock our slow steps, we were greeted by a band of yellow-coated Buddhist lamas from the Dubdi monastery, the oldest in Sikhim, who played us into camp at Yoksun with fifes and drums, horns and clashing cymbals.

We had returned to the land of men, of temples and villages. Our march became a progress. At every few miles we found a roadside arbour garlanded with yellow flowers, a table spread with bananas and oranges, and bamboo mugs full of murwa, or native beer.

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* Mr. White, however, lost a coolie in one of the torrents that cross the track.

At the monastery of Pamionchi, perched on an exquisite hilltop (6600 feet) in a natural park, a devil-dance was performed in our honour —for a handsome fee—by a party of young lamas who were going up to Alukthang to offer a week's service to the demon of Kangchenjunga.

On the fifth day from Jongri, including one of rest at Pamionchi, we regained Darjiling; we exchanged narrow tents or dak bungalows, in which the rain came through the roof, and our feet went through the rotten floor, for European houses. In short, we returned to civilization.

Our journey had occupied in all seven weeks, during which we had ascended and descended some 75,000 feet, or 14 vertical miles up and as many down. We were twenty-four days between Lachen and Khunza without meeting inhabitants, twenty days without seeing trees. Except for a few contributions from our sportsmen, we were during this time wholly dependent on the provisions we carried with us.

I should like my concluding words to be of very sincere thanks to the Indian authorities, who, from his Excellency the Viceroy downwards, in the most generous and sympathetic spirit, did everything in their power to help us in our novel enterprise; and more especially to Captain Le Mesurier, the acting Political Officer in Sikhim, and his wife, who came with us as far as Lachen, and blocked the retreat of our coolies; to Mr. Dover, our most able and energetic and cheerful companion, who ruled the camp with gentle firmness; and to Mr. Earle, the Assistant Commissioner at Darjiling, who sent relief parties to meet us on our return march.

Before the reading of the paper, the PRESIDENT said: We have to offer our thanks to the Board of Works for the new electrical installation which has been put up entirely for our benefit, and which I believe will be used the first time this evening, when we welcome amongst us our very good friend Mr. Freshfield. You all remember what excellent papers he has given on the Caucasus, and now he is about to describe to us his very remarkable journey round the great mountain mass of Kanchenjunga. I will now call upon Mr. Freshfield to give us his paper.

After the reading of the paper, the following discussion took place:—

Sir THOMAS HOLDICH: I should like, if it won't detain you too long, just to make one or two remarks about the map which you have in your hands to-night. It is an interesting map, because it represents somewhat a new departure in mapping. You will, at any rate, agree that it is a very vast improvement on its predecessors. Now, Mr. Freshfield has referred to the manner in which the previous maps were made. Any map, made as they were from a distance, must necessarily depend on what we may consider as conjectural topography, particularly as regards glaciers and ice-fields. It will be, as a matter of fact, more or less a fancy map. Now the question is—and I think it is a question which really deserves deep consideration by this Society—whether this new system of making maps by the conjunction of photography and topography, which they now call photo-topography, can ever lift our maps entirely from all regions of fancy on to a solid basis of topographical fact. For my part I am rather inclined to doubt it. The only people that I know who have satisfactorily exploited this system

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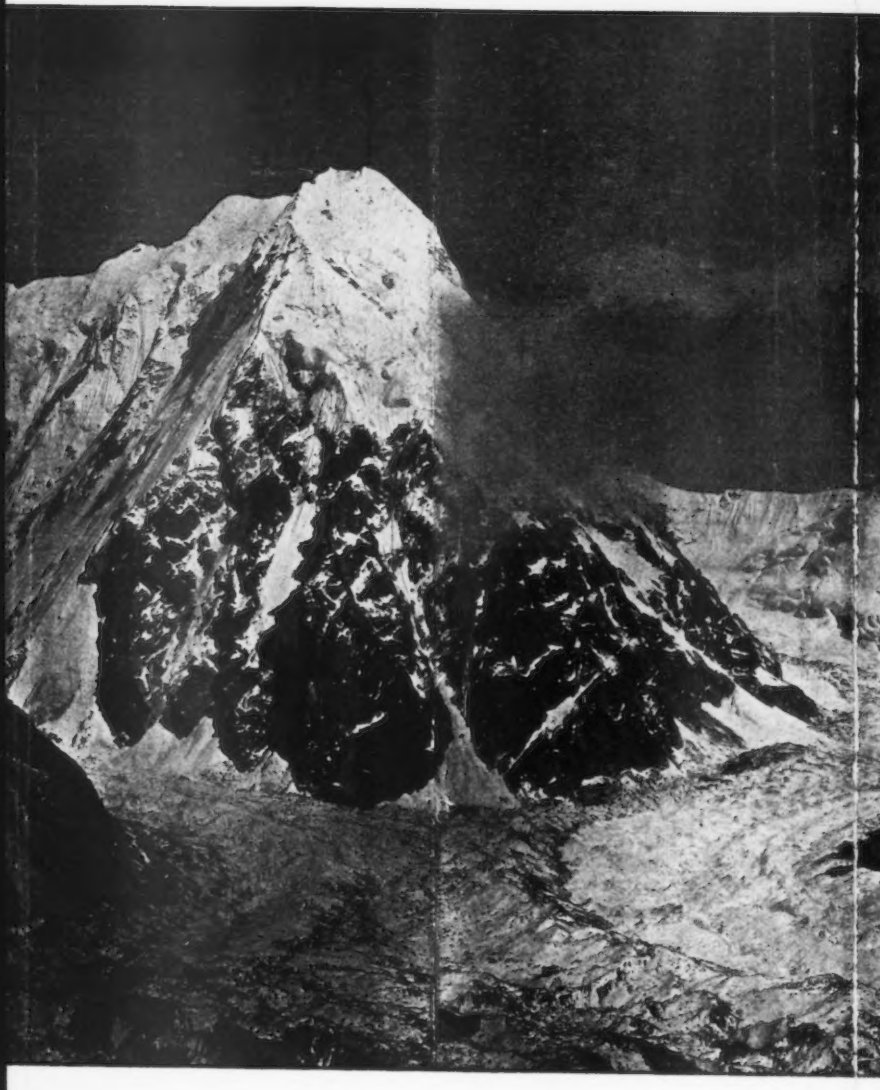

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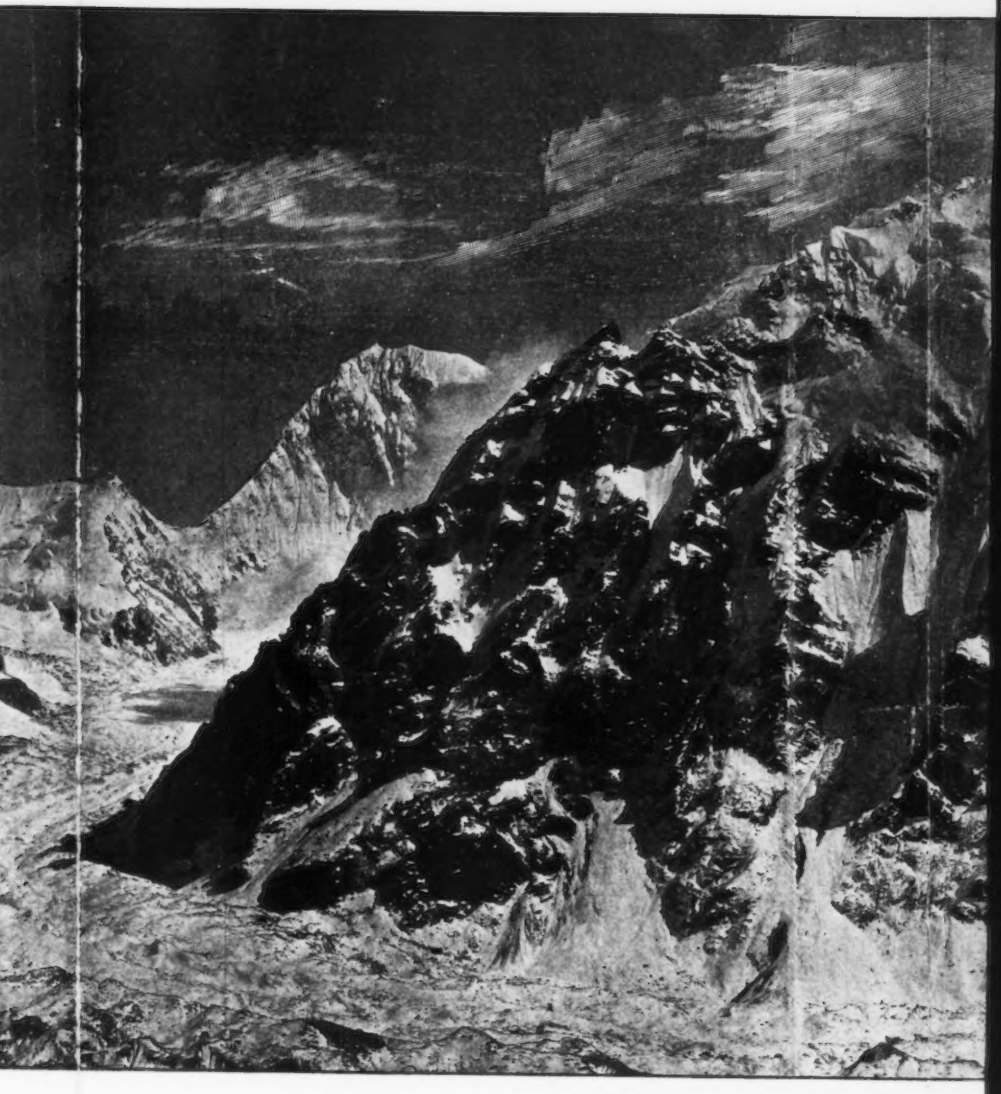

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KANGCHEN GLACIER IN NEPAL

From a height of 17,000 feet.

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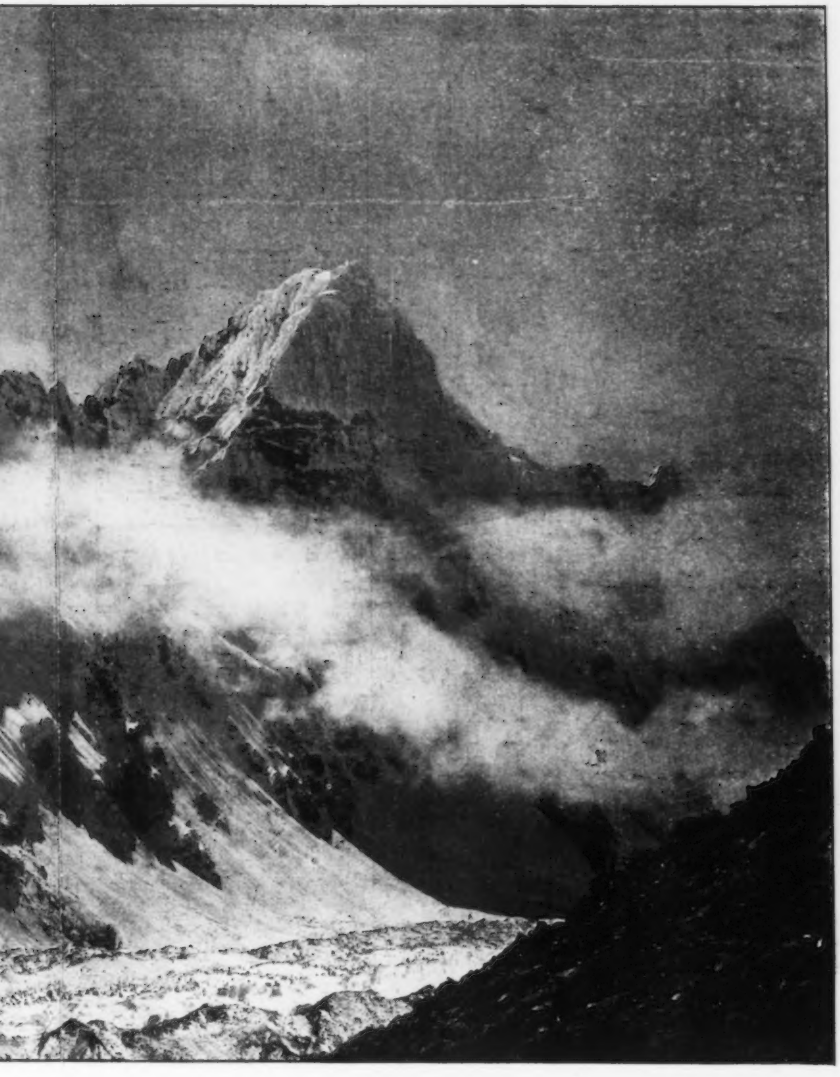

V. Sella, Photo.

are the Canadians, and their verdict, after very considerable experience, seems to be this: That, whereas, under all ordinary circumstances and conditions of atmosphere, the map which results from this process is hardly to be compared for finish and detail with the topographical map carried out by the ordinary process, yet there are certain exceptional atmospheric conditions—where, for instance, from the prevalence of clouds only passing glimpses may be obtained of glaciers and peaks—where the art of photography may come in to the aid of topography. There is one thing, however, that the Canadian map-makers hold to be most important, namely, that the man who takes the photographs should be the man who makes the map. It is difficult enough to make a good topographical map from the features of nature. But it demands even higher training to make a map from a photograph, in which very much of the detail is either lost, or at any rate, very obscure; and for this reason the Americans maintain that the cartographer should be the man who makes the map in the field; that he should be a past master in the art of topography first and a photographer afterwards. Mr. Freshfield was not fortunate enough to secure these advantages. He had, so far as I know, no past master with him. Certainly my old friend Rinsing cannot figure as such, and I doubt whether, under any circumstances, there is any topographer at present of sufficient training to undertake the double duty. Certainly, amongst the latest surveyors of the Indian Survey, I knew no one who united practice in the art of topography and photography. Under these circumstances we must, I think, consider this map as more or less an experimental map, and I think this Society owes a very deep debt of gratitude to Mr. Freshfield for having carried out this experiment with so much ability. In this connection it may be interesting to you to know that in the very much larger fields of glaciers and snowfields which lie to the north-west of the Himalayas, there is a prospect of photo-topography being applied to the production of our maps. I hope to hear soon that the best of our professional surveyors have carried with them their photographic apparatus, and I feel tolerably certain that the result will be that, although there must always be in high altitudes slight elements of uncertainty and conjecture—certainly about the higher peaks—yet that, for all practical purposes, the mapping realized will be quite as accurate as anybody can require.

Mr. A. W. Paul: I would only like to make one or two remarks. Rinsing was a boy who was educated at the school we started some years ago in Darjeeling, and I do not think he ought to be quoted as a man who can make a map of a journey. On this particular journey to which reference has been made, he was not the head of the party. The head of the party unfortunately lost his life, and it was with very great difficulty that Rinsing and the others escaped; therefore I hope you will not judge him too harshly, if he was unable to find his way back again over a pass which he only crossed once in the opposite direction. I have one other remark to make, and that is with reference to Darjiling being chosen for the station. Surely a good many reasons, apart from historical ones, could be given why that should be selected. I have been over the greater portion of what has been called Independent Sikhim, and doubt very much whether, with all due deference to Mr. Freshfield, you could find a better site for a station than Darjiling. It has a great many faults, but in the first place it is accessible, and in the second place it has water. Now, most places in that district are deficient in this commodity which is absolutely essential; we cannot, therefore, be blamed very much for having stuck to Darjiling. If you only knew the cost of carriage which you would have to pay for the very smallest necessity of life, leave alone luxuries, you will see at once that Chumbi, although very delightful in other ways, is absolutely out of the question.

Dr. BLANFORD: I certainly have some knowledge of Sikhim, but I have never been in that part north and west of Kanchenjunga of which Mr. Freshfield has been talking this evening. In the first place, I have to congratulate Mr. Freshfield on having accomplished a task that has long been very much desired, and I think in addition to this he has done important service to geography in several ways. There are many of us who look upon the view of Kanchenjunga from Darjiling as one of the views of the world. It is very satisfactory to hear from a traveller who has had so wide an experience as Mr. Freshfield, that he agrees in this opinion. I think the upper valley of the Lachung, which is the valley to the east, is more beautiful than the Lachen valley. The Lachen valley, when I passed through it, was singularly inaccessible. Here and there on the route it was necessary to traverse difficult places like that of which an example was shown on the screen in one of the photographs. The Lachung valley was more accessible, and it is interesting on account of the enormous moraines by which it is crossed, and which are the remains of former glaciers. Mr. Freshfield spoke of there being a moraine just over 8000 feet above the sea. This is below Lachen, and there is a specially large moraine in the other valley, and that can scarcely be more than 7000 feet above the sea. The shape of the valley below Lachung is such that it is very probable the glacier came farther down, and this leads me to a point that has been remarked upon by both travellers, and especially by Mr. Garwood, the peculiar form of the Sikhim valleys. I was some time ago talking with a very experienced European geographer and geologist about the remarkable shape of the Himalayan valleys, and I told him it was my impression that people whose experience is confined to Europe may never have seen a valley shaped by pure fresh-water denudation-rain and river. The larger valleys in mountainous parts of Northern and Central Europe have almost always been partly moulded by ice. But, although the glaciers in Upper Sikhim undoubtedly came down in places to about 7000 feet, there are no glacial markings in Lower Sikhim. The whole of the denudation is pure fresh-water denudation, and this is of great antiquity, for, although the evidence has not been found in the Eastern Himalayas, in the Western Himalayas there is clear proof that the valleys which now cut their way out of the mountains were cutting their way out long before the glacial period, in Pliocene and perhaps even in Miocene days. I will not detain you any longer; I can only congratulate Mr. Freshfield and Prof. Garwood on the results of their journey, and on the very beautiful examples they have brought back with them.

Mr. FRESHFIELD: I have only a few words to say with regard to the various remarks made by speakers. With regard to Sir Thomas Holdich's remarks, I entirely agree that the work of a trained staff of surveyors is the best thing you can have. But how many years will it be before the Himalayas can be surveyed in that way? In the mean time, need we be content with the "conjectural topography" of the existing Survey maps, or may we endeavour to supplement it by means of the camera and plane-table, in the use of both of which my companion, Mr. Garwood, had had previous practice? With regard to what Mr. Paul said of Rinsing, I did not quote him as in any way responsible for our map produced to-night, nor did he furnish me with the material used in its construction,* though he was most useful to us as a local guide and in many other ways. I quoted Rinsing as the sole cartographic authority Colonel Gore, the present Surveyor-General, could refer me to for the Nepalese valleys west of Kangchenjunga,

* With one exception, the central portion of the Talung Glacier, for which he is mainly responsible. For further details, see the note which will accompany Prof. Garwood's map.

and I exhibit to-night in the tea-room the manuscript map of those valleys made by Rinsing on his previous journey, and kindly sent me by Colonel Gore. With regard to the sites of sanatoria which may in the future supplement or rival Darjiling, bearing to it a relation similar to that of the Engadine to Monte Generoso, I think any detailed discussion would be at present premature. I regard this as a question of the future; its solution depends chiefly on the construction of light mountain railways similar to those which are being constructed everywhere in the Swiss Alps. Mr. Blanford's praise of the scenery of the Lachung valley I entirely endorse. I was fortunate enough to walk up the lower portion of it, nearly as far as the chief village.

The PRESIDENT: It remains for us to thank Mr. Freshfield for his paper. He has led us into a most important and most interesting geographical subject. One's mind goes back to the time when those great peaks were first measured, fifty years ago, when the Himalayan series—I believe the longest between two measured bases that ever was taken—when that series was measured along the foot of the Terai, in so noxious a climate that over forty or fifty of the native surveyors and three officers died, and I believe that party had to be renewed more than twice. It was under such tremendous difficulties that seventy of those peaks were first measured. A long period has elapsed since then, and it has not been possible, owing to the pressure of work in other parts of India—and most marvellous work it is, that work of the Indian Survey—owing to political difficulties, and still more owing to financial difficulties, for surveyors to reach the bases of those peaks, or the greater part of them; and their glaciers have not been explored. It is a matter for the future. This is one of those great regions of the Earth which are unknown and unexplored, and we look forward to the extension of our knowledge there at some future time. But there can be no question with us to-night that Mr. Freshfield has made a most remarkable commencement of that exploration by his journey to Kanchenjunga. We have to thank him for a most interesting paper, which included that very eloquent description of the beauty of the scenery passing through the valleys to the higher land at the foot of the ice, and we have to thank him for the marvellous series of photographs which have brought still more clearly to our minds the beautiful description which he gave of that scenery. We also have to thank Mr. Garwood for his interesting remarks on some of the physical features of the country, especially respecting the hanging valleys. I would ask you, therefore, to pass a very cordial vote of thanks to Mr. Freshfield for his paper, and to Mr. Garwood for his address, and for the very beautiful series of photographs, taken by Signor Sella and Mr. Garwood, that Mr. Freshfield has shown to-night.

THE RUSSIAN POLAR EXPEDITION IN THE "SARYA."

By Baron ED. VON TOLL.

LEAVING St. Petersburg on June 21, 1900, the *Sarya* first touched at Kronstadt and Revel. At the latter port, on June 26, I quitted the ship to go by way of Helsingfors, Stockholm, and Christiania, to Bergen, whither, under command of Lieut. Kolomeitzov, the ship steered a straight course. At Christiania I was indebted to Prof. Nansen for many valuable advices and suggestions. On July 3 I caught up the *Sarya* at Bergen. Here from different towns were

collected the instruments and articles of outfit destined for the expedition. On July 7 I gave orders to weigh anchor, and, passing by the rock-strewn coasts of Norway, we put in at Tromsö. Leaving this place on the 21st, we doubled the North cape on the 23rd, and with a favourable wind made, at a speed of 7 knots an hour, for the Murman coast. On the 27th we entered the harbour of Alexandrovsk, on the Murman coast. Here there awaited me the non-commissioned officer of the Yakutsk Cossack regiment, Rostorguev, my trusty companion through the expedition of 1893, and Striskev, a citizen of Ustyansk, with twenty East-Siberian draught-dogs, which, unwearied by the nearly 8000 miles (12,000 versts) they had already covered, were in excellent condition. Here, besides, I received forty Ostyak dogs, brought to me by A. Trontheim from West Siberia.

In respect of the schooner chartered by the Governor of Archangel to carry a cargo of coals provided by the Ministry of Naval Affairs from Archangel to Yugorski Shar, I heard in Alexandrovsk the unwelcome intelligence that, in attempting in the middle of July to reach Waigats, she was so damaged by the ice as to have to return to Archangel. The damage, however, could not have been so serious, seeing that, by direction of Herr von Engelhardt, the schooner was to set out anew on August 2 for its place of destination, Cape Grebeni. When, on July 31, the *Sarya* cleared the harbour of Alexandrovsk, I might, under favourable circumstances, hope to meet the schooner at Cape Grebeni. On August 3, near by the island of Kolguev, we encountered a stiff contrary wind, so that under full steam the progress of the *Sarya* was reduced to two knots. It therefore became apparent to me that the sailing schooner would reach the cape so very much later than I, that, unless at a fatal cost of time, it would not be possible for me to await its arrival there. In this way we found ourselves denied the opportunity of renewing the supply of 300 tons of coal we had shipped on steering out of Alexandrovsk, before making our entry into the Polar sea. On August 7, finding an ice-clear opening into the Yugorski Shar, I took advantage of the favourable moment, and the same day attempted the passage into the Kara sea.

Without halting at the village Nikolskoye, we steamed under a light S.W. wind through the Yugorski Shar, and at eight in the evening of the same day we were in the Kara sea. Till midnight we were able to hold on our north-easterly course, meeting till then open waterway and only here and there broken ice. On the morning, however, of August 8 we were forced to abandon this course, entering, as we did, fields of ice. Skirting their edge, we had to penetrate, in a south-easterly course, deeper into the bosom of the Kara sea. For some 70 nautical miles we held on to the south-east, often beating about in fog between drift-ice. On August 8 the first hydro-zoological station was set up in the Kara sea —the seventh from Alexandrovsk. On August 9 we came on so much

ice-free water between the fields of ice that, sailing by the boundary-line of the ice-fields between light drift-ice, we were able to resume a north-north-easterly course. From August 11 onwards, we remarked the influence of the warmer water of the Obi. The navigable way was freer from ice, and grew freer still the nearer we approached the mouth of the Yenisei. On the afternoon of August 12 we sighted the island of Kuskin, on the east side of which, under 73° 30′ N. lat. and 80° 55′ E. long., lies Dickson harbour, the name given it by Nordenskiöld. Here, for the sake of cleaning our boiler, a measure necessary to take in hand before launching into the region of the unknown, we made a halt of six days. By way of scientific utilization of this detention, we did our best to explore the region in all directions.

On the afternoon of August 18 we steamed out of Dickson harbour. Steering 30 nautical miles to the north-east, we struck on ice, which, however, did not hinder our progress. Next morning we sighted an island, which, both from the map and from Nansen's drawing, I was able to identify with the largest and the southernmost of the Kamennye islands. This was the last time throughout the whole passage, on to as far as our winter haven, that we were able to orientate our situation according to existing maps. Here, then, was the beginning for us of a trying time, seeing that not one line of the mapped coast, not so much as one of the many islands, answered in its situation and form to the facts presented to our eyes. We had, moreover, continuous fog and much drift-ice, compelling us frequently to veer round into even a southerly course. The further progress we made in the region of the rock-strewn Taimyr bay the more difficult became our course. The fog being thicker by night than by day, I had the *Sarya* moored by night to floes or cast anchor, for fear of being carried farther out of our way in the fog. Thus on the night of August 19–20 we lay moored close by a cape or island to the north-east of the mouth of the Pyasina, while on the night of August 21 we lay anchored near an island belonging, perhaps, to the group of the Scott-Hansen islands.

Hitherto I had been lucky in finding navigable water outside the rocks. Now, however, I was forced by the ice to sail between the rocks and the continent. In this course we soon got into a labyrinth, of the beginning of which we were warned by striking on a stone, to clear ourselves from which took us three hours' work with the kedge-anchor, and the reversed engines all the time put at full steam. The next day we discovered a deep bay, parted into many lateral arms, which I propose calling Minin bay, from Lieut. Minin. On August 26 we doubled a cape, perhaps Cape Sterlegov, after which we shot into good navigable water, in which we made fair speed. Next morning, however, the way was barred by thick drift-ice and fields of ice. Only to the east was there an open road cutting deep into the land. As in the last few days topographical determinations had become impossible from the

clouded state of the skies, while the reckoning of our course suggested the possibility of our having reached the entrance into the Taimyr sound, I resolved to turn into the channel to have this question settled, and to await a favourable change in the conditions of the ice. After we had taken shelter in the sound in question, the sky still refused to yield us any determination of our situation. A sounding taken by Lieut. Kolchak on the steam-cutter showed that the depth declined in an eastward direction. Yet whether we should find a passage open for us or should be running into a fjord, was a question not to be decided in the thick fog. On August 28 I therefore made the attempt to circumnavigate the field of ice which, outside this questionable route, had fixed itself in a direction from south-east to north-west, in front of the mouth of the channel. After steaming 30 miles westwards, along the edge of the ice-field, without reaching the end of it or discovering any opening in the ice through which we might recover our course, I resolved to turn about and again seek the shelter of the dubious channel, in order to there await the disruption of the ice-masses, to settle the problem whether the channel in front of us were a sound or a fjord, and in any case to look out a site suitable for us as a winter haven. The channel in question was not long in discovering itself to be a fjord-like bay, cutting deep into the land. Here we passed nineteen days, from August 28 till September 16.

The labours carried out in this interval enabled us to determine that this channel was the first one on the coast of the western Taimyr peninsula, in which many scientific investigations have been made and geographical determinations of place instituted. In memory of Alexander von Middendorf, the first explorer of the Taimyr land, I should, therefore, like to have it named Middendorf fjord. In order to observe the movements of the ice in the sea, and not to lose any chance of navigable water that might offer itself, I had the anchor cast first near by the mouth of the fjord. A strong movement, however, of masses of ice, drifting in from the sea, compelled me to seek more protected anchorage deeper in the interior of the fjord. In a north-western bight of the fjord there was found a harbour very well qualified for winter quarters. In honour of the last fellow-leader of Middendorf, the founder of the climatology of Russia, K. S. Wesselovski, I should be disposed to call this harbour Wesselovski harbour. Though there was here plenty of driftwood to serve us in the way of fuel through the winter, and though in Wesselovski harbour we should have been safe from all pressure of winter ice, yet I could not reconcile my mind with the idea of wintering here. Apart from the dangerous road in this fjord, I was afraid of the possibility of not finding next summer a free passage out into the sea. Already, during our stay, the entrance by which we had sailed in was blocked with thick drift-ice. Another outlet out of the Middendorf fjord was still open, the more

southern of the two, but, to judge by the many drift-ice floes there lying on the ground, it seemed to be much shallower than the arm by which we had sailed in. I commissioned Lieut. Kolomeitzov to take soundings of this water, and it was found, in fact, that, taking all due precautions, a through passage might be effected. On September 16 we happily cleared the Middendorf fjord. The masses of ice had, however, parted only a little, just enabling us to get round the next islands, sailing as we did through the ice-holes. Soon, however, fields of ice again lay spread out before us, compelling us to put back to the first island of that group. On September 18 I again attempted to penetrate further to the north, and, were no better course open, to sail round the west side of the group of islands named by Nansen the Nordenskiöld islands. The result was not more favourable. Towards the north we again encountered unbroken ice. After the *Sarya* had been moored, on the night of September 19, to a drifting ice-floe, and the dawning day brought no improvement in the situation, I had the ship turned shorewards. Here we discovered a new bay, named by me Kolomeitzov bay, which, in case of necessity, would have served as a good winter haven. In the hope of a north wind springing up, such as could alone part the ice, we waited till September 22. What was hoped for came to pass, so that on the 22nd, under full steam, the *Sarya* again made a forward movement—but not for long. We made but a few miles, when the ice forced us to put in at the next bay. Here, from a mountain, I at last caught sight of the Taimyr sound, from which, however, ice-masses still barred our way. In this bay we waited till September 25, on the morning of which day, from my mountain-top, I noticed that the ice was split up at one part and new ice-holes formed. I determined to make a final effort to penetrate as far, at least, as Taimyr sound, if that were to be our ultimate goal for this year. Meanwhile winter was approaching. The tundras had already long drawn over them their mantle of snow. The temperature of the air stood constantly under zero. That day it was $-2°{\cdot}2$ C. (28° Fahr.), the temperature of the sea-level being $-0°{\cdot}78$ C. (30°·6 F.). The chopped ice floated about like a thick stew.

On September 25 we succeeded in clearing out of this bay (called by us Wolf's bay) and reaching the group of Nordenskiöld islands. Stretched between the islands there still, however, lay an unbroken barrier of ice, which, not broader than a few nautical miles, yet opposed an insuperable obstacle to our entrance into the blue open sea spread out, as far as the eye could reach, beyond the islands.

Here the *Sarya* lay at anchor till next day. On September 26 the temperature of the air registered $-5°{\cdot}8$ C. (21°·56 Fahr.); that of the water $-0°{\cdot}8$ C. (30°·56 Fahr.). All around the ice spread out as a firmly connected mass. Our anchorage lay completely open to every pressure of the surrounding ice. In these circumstances, it did not seem advisable to wait on a north wind springing up to cleave this ice-barrier. I had,

therefore, no resource but to turn about and steer the *Sarya* into the next bay. After a few hours we shot into a sound blocked in the interior by firm ice. Here, for the first time since leaving Kamennye islands, I was able to calculate my topographical bearings from existing maps—from the sketch, namely, given me by Nansen before setting out on the expedition, in which Colin Archer harbour, discovered by him, was recommended as the best resort for first winter quarters. We now steamed exactly by this harbour, in a road forming the western entrance into Taimyr sound. Here, 2 miles from Colin Archer harbour, in a roadstead protected on every side from all ice-pressure, we moored ourselves to a great floe joining us to the mainland, there to have our experience of a first wintering.

In our passage to the east of the Kara sea, it was, then, our fortune to encounter highly unfavourable conditions of ice, caused by the prevalence of E.N.E. and S.S.W. winds, with the abeyance of N. and N.N.E. winds. So soon as the *Sarya* was fast frozen in, and the surrounding ice sufficiently solid, we entered on our wintering preparations —putting in train the tasks connected with our meteorological-magnetic station, and with the hydrological and zoological investigations to be pursued under the ice.

The first half of the winter and two-thirds of the winter night passed quickly, thanks to our regular and many-sided labours. With the return of the sun, which, having disappeared below the horizon on October 31, will not again touch the horizon till February 10, 1901, preparations will be made for sledging expeditions.

PROF. AGASSIZ' EXPEDITION TO THE MALDIVES.

Towards the end of last year Prof. A. Agassiz carried out an expedition to the Maldives for the purposes of studying the physical geography of the group, together with biological research in the waters by which it is surrounded. By the end of January the expedition was back at Colombo, whence the leader wrote to Prof. Dana an account of the main results obtained, which has been printed in the *Ceylon Observer*. From this we take the following condensed summary of the work accomplished and Prof. Agassiz' conclusions respecting the physical history of the Maldives.

For the purposes of the expedition the s.s. *Amra* was chartered from the British India Steam Navigation Company, the vessel being commanded by Captain W. Pigott, R.N.R., under whose superintendence the whole of the soundings carried out (more than eighty in all) were executed. The *Amra* was equipped with a Lucas sounding-machine, which Prof. Agassiz found to possess some advantages over the Sigsbee machine used by him on all his former expeditions; and had in addition a Sir William Thomson sounding-machine for use in moderate depths. The personnel of the party included Dr. W. McM. Woodworth (with general charge of the collections), Mr. Maximilian Agassiz, and Mr. H. B. Bigelow. In the short time available the collections were necessarily somewhat limited, but thirty species of Medusæ were obtained by Mr. Bigelow, while the hauls with the dredge, both from

deep water and from the surface layers within the lagoons, were at times very productive, the latter being found far richer than in the lagoons of any other coral reef region visited by Prof. Agassiz.

Exploration was started from Male island, North Male being first examined, after which the various atolls of the southern part of the group were visited during a southward cruise to Addu, the southernmost atoll of all, and the return voyage northward. The return route was so arranged that the atolls missed on the way south—Wattaru, Felidu, and South Male—were now examined, while in the case of atolls visited on the outward voyage, other parts were examined and the lagoons crossed in different directions, in order that a bird's-eye view of the whole might be gained. The northern part of the archipelago was afterwards examined, and a final exit made through one of the passages on the east face of Ihavandifulu, the northernmost atoll of the group, after a total course of nearly 1600 miles steamed among the atolls of the Maldives.

The soundings made by the expedition were directed chiefly to the filling up of gaps in the existing information, especially with regard to the depths in the channels separating the groups of atolls, and the slopes of the eastern and western faces of the Maldivian plateau. They thus supplement the similar work done by Mr. Stanley Gardiner. On the way back to Ceylon some gaps in the line of soundings previously fixed were filled in, the result being to clearly develop the existence of a wide tongue of ocean, with a depth of over 1500 fathoms, running north of 9°, and separating Minikoi as well as the Maldives from the Indian continental slope. Within the lagoons of the composite atolls no great number of soundings seem to have been taken, as existing charts were considered to give a satisfactory idea of the general topography of the bottom. In some regions the changes in depth are very abrupt, and the character of the bottom varies greatly according to locality and the vicinity of gaps, passes, islands or islets, and sand-bars. On one occasion the claspers brought up a piece of millepore, cut from a living cluster from a depth of 39 fathoms—an unusual depth for a reef-builder, as in the Maldives the reef corals rarely extend below 17 fathoms, sand-lanes and patches usually beginning at 12 fathoms.

The maximum depths of the narrower channels examined were generally found to be between 200 and 350 fathoms, but in some cases much greater depths were met with. Thus 769 fathoms are recorded in the centre of the channel between Miladumadulu and Fadifolu, 374 fathoms between South Male and Felidu, and 649 between Mulaku and Kolumadulu. In the centre of the channel between Gafaru and North Male, only 100 fathoms were found. In the wider channels separating the atolls of the single southern chain, the depths are greater than any yet mentioned. Thus in the centre of the channel between Kolumadulu and Hadumati the depth was 1118 fathoms, and between Hadumati and Suvadiva 1130 fathoms. In the wide channel between Suvadiva and Addu, a depth of 1292 fathoms occurs a little to the north of Fua Mulaku, and 1048 between it and Addu. Owing to rough weather, the line could not be continued beyond Addu towards the Chagos group. The bottom samples of the deeper soundings were interesting as showing the existence of Globigerinæ in great quantities at a comparatively short distance from the shallower waters of the Maldive plateau: they were frequently so abundant as to form what might be called Globigerina sand. Nearer the atolls Pteropod shells were common, especially on the outer face of the groups, and in two cases small manganese nodules were brought up from the bottom of the channels.

The soundings taken on the east and west faces of the plateau are said to indicate a comparatively steeper slope off the western than off the eastern face,

Thus 8 miles west of the southern part of North Malosmadulu the depth was 1247 fathoms, and at a similar distance off the south-western face of Ari, 1499; while east of South Male 1270 fathoms were found at a distance of 12 miles. Yet the soundings on the charts quoted by Prof. Agassiz indicate a depth of over 1000 fathoms off the south-western face of Ihavandifulu at a distance of nearly 12 miles, while off the north-east face nearly the same depth is reached in less than 6 miles. In the wide basin which separates the eastern from the western chain of atolls, the depths varied from 519 fathoms (between Fadifolu and South Malosmadulu) to 186 fathoms (5 miles west of North Male). The bottom of all the channels separating the composite atolls appears to be flat; the soundings drop rapidly, and generally at a distance of a mile and a half from either face they reach a depth but little inferior to the greatest depths in the centre of the channels. The greatest depths thus far obtained in the channels separating Minikoi from the northern Maldives (1179 fathoms) and from the Laccadives (1197 fathoms) are about those which separate the southern Maldives from one another and from the central part of the group.

Both Minikoi and the Laccadives, as well as the southern and northern Maldives and some others, rather resemble such Pacific atolls as characterize the Ellis and Gilbert groups than what has been called the composite Maldivian atoll. A glance at the Admiralty chart will show the great difference in structure between such atolls as Makunudu, Kardiva or Addu, and groups like North and South Male, North and South Malosmadulu, and others. Again, such atolls or groups of atolls as Fadifolu, Felidu, and Mulaku combine features characteristic of the Maldivian atolls with those of many Pacific forms; while others like Kolumadulu, Hadumati, and Suvadiva recall some of the larger Pacific atolls in the Marshall, Ellis, Gilbert, or Caroline groups, noted for the absence of shoals or islands in the lagoons, and contrasting with the typical agglomeration of the small Maldivian atolls along the 30 to 40 fathom belt of the great plateau, which have grown up as distinct parts and are separated by deep channels. Although in such clusters as North and South Male the well-marked rims recall the rims of the great Pacific reef-flats, it is in the structure of such groups as Miladumadulu and Tiladumati that we obtain the key to a rational explanation of the formation, in general, of the atolls and groups of atolls in the Maldives.

These two groups are not themselves atolls in any sense of the word, but are made up of a great number of small atolls, often separated by considerable distances, which have grown up from depths of 25 to 30 fathoms. They can be seen, as in North Male, in all stages of growth, from the flats or mere rings not rising more than 5 or 6 fathoms from the top of the plateau to the rings just awash, or with sandbanks rising a foot or so above the surface. The shape need not be circular, being controlled by the topography of the bottom. In some cases the lagoons of the smaller atolls have been formed by the growth, lagoonward, of patches or lines of coral which have eventually become joined. There is no evidence that these small atolls are the result of the splitting-up of larger atolls, or that adjoining atolls or reef-flats have coalesced, except where the passages between have been of very moderate depth.

The outer slopes of the rings, to a depth of from 8 to 12 or even 15 fathoms, are characterized by a luxuriant growth of coral, contrasting strongly with the scanty growth in the lagoons of the Pacific atolls. This is explained by the wide and deep passages through the rims of the so-called atolls, which passages are generally larger than the space occupied by the small atolls (atollons). As soon as the flats of the rings have reached the surface, sand-bars form and develop into islets, and finally into islands with scrub vegetation and bushes, and sometimes large trees. The rings, or "faros," either retain a central lagoon, or it becomes wholly or partially

filled up by the growth of the land. It is comparatively easy to trace the progress of growth through all the various stages.

The small atolls which form the outer rim of the composite atolls owe their existence to the same causes, and the increase in size of the islands goes on much in the same way as has been observed in the Gilbert, Ellis, and other Pacific groups. Small islets on the same reef-flats are gradually united by the formation of sand-spits on the lee face, thus forming bays on the sea face which are gradually filled up, the former gap being indicated in time merely by a difference in the vegetation, a distinction which gradually disappears. The existence of lagoons completely shut off from the sea in some of the northern atolls can be similarly explained. At first there will be merely a crescent-shaped island, between which and the rest of the reef-flat of the ring there is comparatively deep water. Spits are thrown out from the horns of the crescent, and finally unite so as to form an ideal atoll—a closed ring of land enclosing a deep lagoon, which exists so rarely in nature. The change from an open crescentic island to a closed atoll may take place with considerable rapidity, as is shown by comparing the charts of seventy years ago with the state of things now existing, various crescentic islands having increased in size by the extension of the sand-spits, while one at least—Rodular-mandu—has, during the seventy years, become a closed land-ring. Fresh water or brackish sinks edged with mangroves can be traced to the operation of a similar process.

These facts, Prof. Agassiz says, point to the uselessness of our present definition of atolls, as every possible gradation can be seen between an open crescent-shaped bank and an absolutely closed ring of land. The evidence of a great number of atolls scattered over an extensive plateau like that of Tiladumati and Miladumadulu shows that reef-corals will grow upon any foundation where they find the proper depth, and that local conditions will determine their existence as fringing reefs, barrier reefs, or atolls. In fact, reefs that once formed an atoll may, when this becomes an island, be transformed into fringing reefs. The composite atolls are merely elevations upon the greater Maldive plateau, which have served as bases, at the required depth, to the reef-building corals; while the secondary plateaux have in turn supplied a number of bases for the formation of atolls. The variation in type in different parts of the group may be ascribed to the varying conditions of exposure to ocean currents.

The effect of the monsoons in the Maldives cannot be compared to that of the incessant breakers which pound upon the reefs and atolls of the Central and Western Pacific, and the boulders thrown upon the reef-flats are pygmies beside the gigantic blocks which often line miles of the beaches of the Pacific atolls. But the same forces are at work, only on a diminutive scale, even during the south-west monsoon. Both sand and shingle beaches are as a whole remarkably steep. They rarely rise to more than 5 or 6 feet, though in some of the northern atolls they are fully 12 feet high. All the reef-rock examined was found to be of the most modern character, and no trace was seen of rock indicating the nature of the underlying plateau, as would surely have been found if existing conditions had been brought about by subsidence. The only evidence points to a very slight elevation having taken place.

Prof. Agassiz praises the accuracy of the charts based on Captain Moresby's survey, which, he says, is something wonderful, when we remember the conditions under which that survey was executed seventy years ago. They proved an unerring guide for the intricate navigation among the Maldives, and though some minor changes have occurred in the interval, they are still a monument of the unsurpassed skill of the surveyors of those days.

A PROPOSED EXPEDITION TO THE NORTH MAGNETIC POLE.*

By Captain ROALD AMUNDSEN.

THERE are, as you are aware, magnetic forces in the Earth which cause the compass-needle to assume a certain position at each place on the Earth's surface. The north end of the needle points northwards, but not exactly in the direction of the geographical north pole. At some places it points east of the true north, at others west. If we were to imagine expeditions starting from various places on the surface of the Earth, and each moving forwards always in the direction indicated by the north end of its compass-needle, these expeditions would at last all meet at a point situated on Boothia, the most northerly peninsula of the American continent. This point is called the magnetic north pole of the Earth. If, on the contrary, these expeditions had taken the direction indicated by the south end of the needle, they would have met at last at a point on the antarctic continent—Victoria Land, near the south pole. This point is called the magnetic south pole of the Earth. These two magnetic poles are also remarkable from the fact that a so-called magnetic dipping-needle—that is to say, a magnetic needle that is movable about a horizontal axis—will at these places assume a vertical position, with the north end downwards at the magnetic north pole, and with the south end downwards at the magnetic south pole, while everywhere else its position is oblique; that is to say, making more or less of an angle with the horizontal plane. This angle is called the magnetic dip. Thus the dip at the Earth's two magnetic poles is 90°. The lines passing through all places with the same dip are called isoclines. The isoclines run round the Earth from east to west in the form of continuous lines. The isocline passing through all places at which the inclination is 0°, in other words, at which the needle assumes a horizontal position, is called the Earth's magnetic equator. It intersects the geographical equator in two points, in such a manner that about half of it, on the western hemisphere, lies south of the equator, and the other half, on the eastern hemisphere, north of the equator. The farther we withdraw from the magnetic equator, the greater is the dip of the north end of the needle in the northern hemisphere, and of its south end in the southern hemisphere, until we come to the magnetic poles, where, as I have said, the inclination is 90°.

In August, 1897, the Belgian South Polar Expedition, with its ship, the *Belgica*, on which I had the honour of being first officer, set out for the antarctic waters. The aim of the expedition was to reach South Victoria Land, and there endeavour to determine the exact locality of the magnetic south pole, of which the position is only approximately known. Plans subsequently made, however, carried us into the ice about Graham Land and Alexander Land, where we lay for thirteen months, frozen into the antarctic drift-ice west of Graham Land. It was here, in 72° S. lat., that the idea of getting to the magnetic north pole and exploring its surroundings first presented itself to me. During the long and comparatively idle winter, our original plan, of determining the position of the magnetic south pole, was of course constantly discussed, and this raised in its turn animated discussion of the question of terrestrial magnetic matters in general, and the situation of the magnetic north pole in particular. Some of the scientific men on board were of opinion that the position of the magnetic north pole was

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* A Lecture delivered before the Norwegian Geographical Society in Christiania, November 25, 1901.

fixed by the determinations made by Sir James Ross in 1831; while others thought that it probably moved a little in the course of time. These discussions awakened a keen interest in me, as I daily had the opportunity of seeing the magnetic instruments we had with us in use, and also now and then of assisting in the taking of the observations. I gradually became more and more desirous of going up myself to arctic North America, and of investigating the conditions around the magnetic north pole, where no one has been since Ross.

Upon my return from the Belgian Expedition in 1899, I immediately began to collect all the works upon this subject that were to be found. The book I sought for longest, but did finally obtain, was Sir James Ross's account of his journey and his investigations on the subject of the magnetic north pole. On reading this book, my longing to find the so-little-known magnetic centre was still further stimulated, and I determined to confer at once with men versed on the subject, as to whether my project could possibly bring to magnetic science any results worth mentioning. With this view, I first applied to the assistant director of the Meteorological Institute in Christiania, Hr. Axel Steen, whom I knew to be at that time engaged in working up the magnetic observations of the *Fram* expedition. Hr. Steen, who immediately expressed his entire sympathy with my plan, and kindly promised to assist me with advice and information, was of opinion that I ought first to make myself acquainted with the magnetic instruments in the observatory in Christiania and with their employment, and then seek an opportunity for more advanced magnetic study at the Deutsche Seewarte in Hamburg. When, acting upon this advice, I applied to the director of the Christiania Observatory, Prof. Geelmuyden, I was received in the most kindly manner, the professor himself showing me the instruments, and giving me some valuable instruction in the various methods used in the determination of the terrestrial magnetic elements.

In the autumn of 1900 I went to Hamburg to see the director of the Deutsche Seewarte, the renowned magnetician Prof. Neumayer, to whom Hr. Axel Steen had kindly given me a letter of introduction. I shall not soon forget my first meeting with the celebrated Geheime Admiralitätsrath, and I must be permitted to describe it in a few words. I was announced and shown into a characteristically furnished workroom, where I found myself in the presence of an elderly man with long white hair. After the usual exchange of civilities, I soon became aware that my stock of German words was becoming exhausted. In vain did I tax my memory to the utmost; I was completely at a loss. How agreeable was my surprise, therefore, when the professor, quickly grasping the situation, came to my rescue by continuing the conversation in English. I now managed comparatively well, and laid my plan before him. To my question as to whether a closer investigation of the position of the magnetic north pole would be of great interest, he replied, "An exact determination of the Earth's magnetic north pole will be of immense value to science." Whatever doubts I may have previously entertained about venturing upon the realization of my contemplated undertaking, they were instantaneously dispelled by this answer, coming as it did from the greatest authority of the present day on the subject of terrestrial magnetic investigations. During the time that I now worked at the Deutsche Seewarte, I was treated more as a welcome guest than as an unknown stranger; and the kind old director himself superintended my studies all the time. The magnetic laboratory was placed at my disposal, with the necessary instruments. The laboratory was the same in which Captain Scott-Hansen, of the Norwegian Navy, had worked before his departure in the *Fram*. I worked there every day, and soon became acquainted with the instruments and methods of observation. The calculation from observations I learnt under Prof. Neumayer's assistant, Dr. Maurer. It was with sincere

regret that I bade farewell a couple of months later to the Deutsche Seewart, with its agreeable and obliging staff. On my return to Christiania, I called upon Prof. Nansen, and laid my plan before him. He promised me his valuable advice in the matter of equipment. Being myself so inexperienced, I am deeply grateful for this kind offer from the greatest polar explorer of the age.

In January of the present year (1902) I went to Tromsö to look for a vessel that would be suitable for my contemplated expedition. I there purchased the whaler *Gjöa*, which is renowned as one of the strongest and best sailing-vessels in the arctic fleet. The reason of my buying it so early was that I wished first to make a voyage in her in the Arctic ocean, and become acquainted with her before starting on the actual voyage. On this arctic trip, which lasted from April to September, I had plenty of opportunity of judging of the qualities of the vessel.

Acquaintance with the various ways in which the Earth's magnetic forces manifest themselves dates back to an early period of history. It is true that the inventor of the mariner's compass is said to have been an Italian, Flavio Gioia, who lived at the beginning of the fourteenth century; but the Chinese are said to have known and employed a special form of this instrument long before our era. It was not, however, until the beginning of last century that the study of terrestrial magnetism, and the consequent collecting and working out of observations from various parts of the Earth, began to increase. I will here only mention the names of my countryman, Hansteen, and the German, Gauss. The numerous English expeditions sent out in search of a north-west passage brought the question of the position of the magnetic north pole into frequent discussion; and Ross's, Parry's, and Franklin's expeditions made it their special aim to obtain observations for the determination of the Earth's magnetic elements. This question, it is true, played a very secondary part in comparison with that of finding the desired north-west passage; but quite a valuable collection of magnetic observations was nevertheless obtained.

The honour of having practically determined, by his investigations, the position of the magnetic north pole is due, as I have already said, to the Englishman, Sir James Clark Ross. His uncle, Sir John Ross, was the leader of the expedition, James being the second in command. The object of the expedition was to find and force its way through the so-called north-west passage with the paddle-steamer *Victory*. It left England in 1829, and passed through Lancaster sound southwards through Prince Regent inlet, where it was hoped a way would be found westwards. The vessel was frozen fast in the ice in the Gulf of Boothia, and the expedition was forced to spend four winters in this region. During this long detention in the ice, they frequently met with Esquimaux who had never seen a European before. The *Victory* never came out again, and officers and crew had to make their way back by the aid of the ship's boats; and were at last rescued at the mouth of Lancaster sound by the barque *Isabella*, which had been sent out in search of the missing expedition. Though unsuccessful in its main object, the scientific results obtained were brilliant. It was after one of the winters thus spent in the ice that James Ross, on May 27, 1831, started on a sledge-expedition with the magnetic north pole as its goal. I will not weary you with details, but only quote a few fragments of his description of the journey. On June 1 he writes: "We commenced, therefore, a rapid march, comparatively disencumbered as we now were; and, persevering with all our might, we reached the calculated place at eight in the morning of June 1. I believe I must leave it to others to imagine the elation of mind with which we found ourselves now at length arrived at this great object of our ambition; it almost seemed as if we had accomplished everything that we had come so far to see and to do; as if our voyage and all its labours were at an end, and that nothing

now remained for us but to return home and be happy for the rest of our days." After expressing his opinion as to how another expedition ought to proceed in order to determine more accurately the position of the magnetic north pole, he says: "Having thus therefore stated, however briefly, what yet remains for future observation—having pointed out what, I may fearlessly say, is still wanting, and which, as such, claims the attention of those who have the power of promoting a work of this nature, I can only express my wishes, if I dare not indulge in hopes, that the same nation which has already carried its discoveries so far, that our own Britain which has already established its supremacy in scientific and geographical researches, will not now abandon them, and leave to others to reap the crop of which it has in this case sown the seeds."

James Ross thus arrived on June 1, 1831, at a spot where the dipping-needle showed an angle of 89° 59′ with the plane of the horizon—in other words, was only deflected one minute from an absolutely vertical position. Practically this one minute is of little consequence, and Ross himself considered that he had now really reached the magnetic pole, whose geographical position he accurately determined to be 70° 5′ N. lat., 96° 47′ W. long.; and, satisfied with this result, he ceased all further investigations, and has thus contributed nothing towards the solution of the question that has since presented itself, namely, whether the magnetic pole is actually only a point, or whether possibly the peculiarity of the needle assuming a vertical position extends over a large area. Theoretical study of recent times points decidedly to the latter supposition. Another question that also demands a practical solution, and which I have already briefly touched upon, is whether the magnetic pole is stationary, or changes its position. It is the solution of these two questions that I have set myself the task of attempting.

I will now pass on to a brief account of the equipment, the route, and the manner in which I have thought of carrying out my plan. I shall start in the spring of 1903 in my vessel, the *Gjöa*. We shall be seven men on board, all told. The reason of my preferring a small vessel like this is that the waters which we shall navigate are very frequently narrow and shallow, and it is thus important to have a vessel that does not draw much water, and at the same time is capable of turning in its own length. A small vessel, especially one of the sloop build, requires a smaller crew, and is in consequence cheaper to fit out. The *Gjöa* is only a sailing-vessel, but I am going to have her fitted with a petroleum engine next year. This I regard as quite necessary, considering the difficult waters we shall have to navigate. The equipment will consist of the usual things required for a polar journey, such as fur clothing, tents, ski, snowshoes of various kinds, sledges, kayaks, etc., as also provisions for four years. Among the magnetic instruments is a travelling magnetometer of Prof. Neumayer's construction. This instrument will resemble that on board the *Fram*, but will be furnished with even more improvements. It has now been in the hands of the Deutsche Seewart's instrument-maker, Hr. Carl Seemann, for a year, and will not be ready until the spring. Owing to the warm interest he takes in my expedition, Prof. Neumayer has designed it especially for this occasion, and has personally superintended its construction. There is, therefore, no doubt but that this instrument will be perfect in every respect. There is also an inclinatorium under construction at instrument-maker Dover's in London. Dr. Charles Chree, the director of the Kew Observatory, has most kindly promised to superintend the construction of this instrument. Thus as regards magnetic instruments, I think I may safely say that I am taking as complete and up-to-date an equipment as the fulfilment of my task can require. The meteorological instruments are baregraphs, barometers, and thermometers.

The oceanographic instruments I hope to be able to take, are sounding-machines,

deep-sea thermometers, and appliances for taking water-samples and bottom-samples. Among other instruments may be mentioned those necessary for navigation and sledge-journeys, such as sextants, artificial horizons, chronometers, and good watches. Petroleum will be used for the heating of the vessel when under way. I shall also take as much coal as space will permit, for use in the galley. During the winter I hope to be able to supplement our store of fuel with drift-wood. On our way westwards, it is my intention to visit one of the Danish colonies on the west coast of Greenland, for the purpose of taking thence some Esquimaux dogs, which will be of great service to us. We shall then make for Lancaster sound, where I hope to be by the middle of July. The course will continue through Lancaster sound and Prince Regent inlet to Bellot strait, where McClintock was stopped by the ice in 1858, when searching for the Franklin Expedition. Should the ice-conditions prove favourable, I intend to go on through Bellot strait, and make my way along the west coast of Boothia, leaving a depôt, if possible, at the spot where Ross found the magnetic north pole in 1831, and then seek for a suitable winter haven, either in Matty island or King William Land. Magnetic observations will be taken as often as opportunity affords. The autumn, 1903, will be employed in making depôts for the coming year. The winter will be employed in making magnetic and meteorological observations. I shall give special attention to the action of the magnetic forces during the occurrence of aurora borealis. Daily observations of ice-information, high and low water, etc., will also be taken. I have thus no doubt but that every man's time will be occupied. As soon as the severest part of the winter is over, I shall set off with three men, two sledges, and as many dogs as we may have, and make for the place on Boothia at which Ross observed the inclination-needle to make an angle of 89° 59′ with the plane of the horizon, making observations all the way. Here, in the first place, a long series of careful observations will be made, after which, taking this spot as the starting-point, I intend to investigate the surrounding region in all directions regarding its magnetic conditions, with determinations of variations, intensity, and inclination, endeavouring, by a choice of stations, to encircle the magnetic north pole, or the region within which the needle assumes a vertical position. The second sledge will be sent back as soon as its aid can be dispensed with, with orders to see to the maintenance of the depôts. I hope, before the winter sets in, to have carried out the principal part of my programme, and in that case I intend to pass the following winter, 1904–5, with one companion, as near as possible to the magnetic north pole. The matter of supplies for my companion and myself, I think of arranging by replenishing the depôts so much during the summer months that they will also be sufficient for winter needs. As observatory and dwelling-house for my companion and myself during this winter, I intend to erect snow-huts after Esquimaux fashion. If my intention is carried out, we shall not be the first civilized men who have passed a winter under a snow-roof; for Dr. Rae, a traveller for the Hudson Bay Company, spent an entire winter with his men here on the north coast of North America, and found it an excellent way of wintering. I have myself had an opportunity of making experiments in this matter, and have found that even in a temperature of −40° C. a dwelling of this kind forms a warm and comfortable abode. Both the first and the second winter, I shall try to set up both the inclinatorium and the declinatorium as variation-instruments, so that regular hourly readings may be taken in connection with aurora borealis observations. The meteorological observations will always be attended to on board.

In the spring of 1903, I think of repeating the work of the previous summer as a check, visiting systematically the old observation points, and there, or in

their immediate neighbourhood, taking a new series of absolute determinations of terrestrial magnetic elements. If this can be accomplished, I shall consider that the object of my journey has been fully attained. Our concern will then be to get back to the ship, and if this is accomplished in the still navigable part of the season, and the ice to the west should prove to be possible of penetration, I shall continue in that direction with the vessel, still taking magnetic observations as frequently as possible. I hope to be able to keep up the meteorological observations all the time without interruption. It is then my intention to make the return voyage, if all goes well and circumstances are favourable, by way of the north-west passage. I have now briefly sketched the plan of which it is my purpose to attempt the realization. It is, of course, possible that circumstances may compel me to alter it in some important points, and I am not blind, moreover, to the numerous difficulties with which I shall have to contend; but I set out with confidence, hoping to return with results which, to some extent at any rate, may prove valuable for scientific investigation.

REVIEWS.

EUROPE.

Britain and the British Seas.

By HUGH ROBERT MILL, D.Sc.

We welcome this first volume* of a new and important series with a pleasure enhanced by anticipation and not diminished by perusal. The book is new, fresh, and forcible, abounding in unexpected theses handled with the skill one looks for from the author. It is obviously the fruit of thought and of wide reading, and invites the geographical public to enjoy its well-elaborated substance, while it tempts the critic to investigate its structure by dissection. The book, and presumably the series, does not compete with any other in the field, but approaches the desirable ideal of illustrating geographical principles by the facts associated with particular localities without giving an exhaustive geographical description. We are much accustomed to geographical writings in which ill-drilled details are put together anyhow, and drift aimlessly to no particular end. There is nothing of that kind here. Every fact brought forward points like an arrow on a map of the winds to a definite conclusion.

Of the two philosophical methods which might be employed in such a work, Mr. Mackinder has apparently chosen the deductive, which is indeed the only way by which a great body of material can be dealt with in a very limited space. It is by far the more attractive also, for it allows of great definiteness of treatment and the citation of a minimum of data, while it gives to the reader the pleasure of discovering

* 'Britain and the British Seas.' By H. J. Mackinder, M.A. With Maps and Diagrams. London: William Heinemann. 1902.

innumerable coincidences of fact with theory. The drawback is that the unanimous trend of facts thus detected has precisely the same logical force as the unanimous resolution of a political meeting to which the public is admitted by careful selection. It involves the choice and maintenance of a theory—originally based on the facts it is brought forward to explain—but does not require that the laborious reasoning which led to its acceptance should be set forth. Hence it is not necessary, in this place, to discuss the basis of the theories from which the deductions are made, though we feel that some, at least, of them are still open to controversy. We are concerned in seeing what are Mr. Mackinder's geographical deductions from the geological and historical theories which he has accepted, and in examining the manner in which he sets them forth.

In the Summary and Conclusion at the end of the volume we find a terse epitome of the whole argument, a slight abridgment of which will convey the best general view of Mr. Mackinder's aims, and of the nature of the facts with which he deals.

Britain is viewed in two historical aspects as it is approached: (1) on the south-east from the continent across the Strait of Dover to the Kentish peninsula and the Thames estuary, leading to the English plain whence land-ways radiate to the higher oceanic border on the west; and (2) over the ocean from the south-west towards the Channel entries whence waterways diverge between the lands. The contrast is similar to that presented in Scandinavia, which may be viewed as formerly continuous with Britain along the west, while the configuration of Scotland indicates a rock-graining from south-west to north-east, which may be interpreted as a relic of a Caledonian mountain range which once crossed what is now the North Sea. The general equality in height of the higher summits of Scotland, and the run of the southerly trending valleys transverse to the rock-graining, can only be explained by the whole surface having been worn down to a base-level and then re-elevated in a vast plateau (called Atlantis) spreading from the British uplands towards Iceland and Greenland. From a portion of this plateau the existing configuration was carved during a fresh cycle of denudation. The greater part of the plateau of Atlantis, meanwhile, collapsed, forming the two oceanic abysses separated by the Scoto-Icelandic ridge, of which the line of median uplands in Britain is a continuation, and no doubt due to the same terrestrial stresses. In front of the south-eastern shore-line of the Caledonian continent a mass of ancient land (on the site of Wales and the Irish sea), which may be called Proto-Britain, was formed; and when the stresses which produced the Earth-folds known as the Hercynian system took place, the resistance of this block diverted their direction, and so determined the triangular outline of Britain. These folds sheltered the coal-basins of Great Britain in their hollows, while the coal-beds of Ireland,

protected from disturbance by Proto-Britain, remained exposed, and were afterwards removed by denudation. A later uplift raised the Wealden fold and brought Britain into physical contact with the continent, the English plain of soft rocks being the eastern coastal plain of the great ancient continent of Atlantis, not the western coastal plain of Europe.

The oceanic gulf which takes the place of Atlantis determines the climate of Britain by opening a way for warm air and a procession of cyclones, while the higher land lies obliquely to their path, and so produces climatic contrasts between the east and west harmonizing with the structure.

Similar harmonies are found with regard to the historical aspects of geography; the east side of the British triangle is opposite the Baltic lands, whence the lighter people spread westwards, while the south side (through France and the gap between the Alps and Pyrenees) faces the Mediterranean lands, whence the darker people spread northward. The radial advance of later conquerors from Kent is illustrated by the terminal remnants of Celtic speech on the ocean border. The four parts of the realm are structural as well as historical units, Wales representing Proto-Britain, while before the industrial revolution the three kingdoms were essentially three lowlands separated by boundary-belts of upland or sea.

The English lowland consists of the soft, tilted, overlapping strata, characteristic of a coastal plain, resting on a buried plain of ancient rock containing coal-basins which are exposed in the north-west. The continental climatic system frequently overspreads this plain, the chief properties of which are breadth, arable fertility, and potentiality of mechanical power. Ireland, on the other hand, with its plain of nearly undisturbed strata lapping round ancient bosses of upland, has no coal, a less complex soil, and an oceanic climate; its surface is consequently generally meadow or bog. The Scottish plain is the smallest, but has a store of coal, and on the lee side rewards cultivation.

"The sites of the three capitals strikingly exhibit the effect of these contrasts. London, in the continental angle, but not far removed from the midst of the English lowland, is a focus of many ways radiating freely over the plain. The most important is that which enters through Kent, and leaves through the Cheshire gap.

"Dublin, opposite to Cheshire, is in the broad coastal entry of Meath, whence roads diverge northward, westward, and southward through gaps among the engirding uplands.

"Edinburgh is in the defile between the Pentlands and the coast, at the head of the sill-entry to the enwalled rift-valley.

"Finally, a vast imperial nodality has been accumulated in London during the centuries characterized by oceanic mobility."

It is plain that a book which seeks to trace the effects of the early

geological movements of the Earth's crust in the latest agglomerations of human population on its surface is not one for careless reading. The attempt to give expression to the ideal is splendid in itself, and we feel that it ought to be successful. But we feel, also, that it is an essay boldly trying to picture what may have occurred rather than a treatise solidly proving what has taken place. It depends for the success of its main contention on the accuracy of the hypotheses of Suess and Davis, hypotheses which are not yet fully accepted by all geologists. These would be legitimate matters for criticism if we viewed the work as an induction from facts; looking on it as a deduction from theories, they do not concern us at the moment. If it is not a logical chain riveted with demonstrated facts, it is at least a garland skilfully arranged and bound together with an attractive thread of probability. It gives fresh interest to a well-worn theme, and should afford useful and stimulating study for geographical students.

Writing in a geographical journal, it is permissible to look somewhat closely into the mode of setting forth the argument of the book, and we wish first to direct our attention to some of the terms employed, although we meet the difficulty of deciding whether these are always meant to be geographical or sometimes to be only literary expressions. Writing in the *Geographical Journal*, we may venture to inquire why the name of the planet is written with a small initial, for in these pages the disrespectful instinct of the compositor is checked, and the Earth is distinguished from the earth. It is true that books usually, and newspapers always, follow the habit; even the paper which gives a capital to the article in its own name—*The Times*. Were it only to guard against the ambiguity in the use of the word *earth* for soil and for the planet, we feel that the capital distinction should be observed. Another point—and this is a trivial one—touches on the use of the article. Mr. Mackinder omits "the" before Solway Firth or Moray Firth, giving a sense of unfamiliar abruptness; probably there is something to be said in favour of the curtailment, yet if so, why (p. 58) "the Great Orme's Head"? It is possible that we may look with too proprietary an eye on the firths, but, setting aside the question of title, the fundamental distinction between the fiords of the west of Scotland and the rias of the west of Ireland is not made plain on p. 22. A ria will not become a fiord sink it never so deeply, as indeed the reader will find implicitly stated when he comes to p. 82.

The word *sill* has been used for generations, if not for ages, to denote geographical features, such as the Great Whin Sill, a prominent volcanic dyke, or the ridge at the entrance to a fiord basin, where the analogy to a dock-sill is very apt. But Mr. Mackinder makes use of sill in a sense that is quite unusual, and we do not see that he anywhere defines the term, if, indeed, he uses it as a definite term and not merely as a general word. It is used apparently for a terrace, raised beach, or

alluvial flat on p. 17, for a belt of comparatively flat land such as a coastal plain in many places, and it is also applied to the continental shelf or to parts of that feature. A sill, be it window-sill, door-sill, or dock-sill, seems naturally to suggest a ridge or narrow elevation between two areas at lower levels, and if applied otherwise should be carefully defined. If the book were to be translated into German, the word *Schwelle* (probably the original form of *sill*) would naturally be used, with very confusing results.

The word *gap* is also used somewhat curiously. As a rule, a gap is taken as implying an abrupt depression between high lands. On p. 285 the site of Edinburgh is thus described: "Between the end of the Pentlands and the coast of the Firth there is a gap, in the midst of which is the Castle rock, and around this, in the gateway leading to inner Scotland, has grown up the capital city of Edinburgh." We have already quoted a passage in which this feature is called a "defile." In either case the words are loosely handled. Viewed from the firth, Edinburgh is seen to stretch along the lower slopes of the Pentlands; from the hills it seems to stand on the plain at their foot. The North British railway certainly does traverse the centre of Edinburgh in a hollow, not a natural gap or defile, however, but a lake-bed artificially drained and embanked; and the Castle rock owed its ancient vantage to the fact that it was the most abrupt eminence of moderate height in a fairly extensive plain, furrowed slightly from east to west, but, as a whole, sloping gently northward to the sea.

One other example, out of several, may be referred to in which definite terms are stretched beyond the limits of their natural elasticity. On p. 292 the author considers that "for the purpose of general description it is convenient to extend" the name of Strathmore to include parts of two different river-basins. But the essence of a strath is that it borders the track of a single river-system. No doubt an argument could be derived from Glenmore, which drains in opposite directions; but the real continuity of the glen differs much more decidedly in nature than on the map from the entire discontinuity of the "extended" strath. In the map on p. 131 the "Strathmore Belt" is shown running through Loch Lomond into the Firth of Clyde, coinciding with what is usually called the line of the Great Fault. The lowland valley of Scotland could be better dealt with by treating it as a plain bounded by the highlands and the southern uplands, and broken by low hills of volcanic rock. The real geographical significance of the old place-names would then require no extension or modification.

Our last criticism as to terminology touches on an old controversy. Are the names applied by Prof. Davis to types of rivers adapted for use in a book not intended solely for the specialist? Mr. Mackinder is not averse to the use of technical names which are sufficiently unfamiliar to lead a careful reader to light upon the defects of his dictionary—

nigresence, nodality, posthumous Hercynian uplift, and *sigmoid*, for example —so that he is not likely to prefer an expression that is ambiguous simply because it is already familiar. To call a river *consequent* because its course is a direct consequence of the original slope of the land is perfectly right, and to call a river *subsequent* because it owes its course to events subsequent to those which produced consequent rivers is not wrong; but once the mind is accustomed to associate these far-reaching connotations with the words, it pauses in instinctive search for some similar meaning before such phrases as "the subsequent kingdom of Scotland" (p. 204), or "consequent wind-swirl" (p. 161). Being free from these objections of pre-occupation, *obsequent* may be hailed as a sort of Mesopotamia of river-terms, though it is not in itself a beautiful word. It seems to us that geographical terminology might take a hint here from the terminology of organic chemistry, and employ some such prefixes as ortho-, meta-, para- to qualify such river-courses as require differential treatment. We suppose that it would be hypercritical to cavil at the contraction of the phrase "an obsequent river" into the crisper substantive form of "an obsequent;" but when such a term is used we think it should be defined.

We fully agree that the conception of development in river-basins with the capture and beheading of rivers, is a most valuable one and very helpful to the student; but the whole group of ideas is still very unfamiliar and difficult. It requires clearer explanation than has been given, and we would like to have seen it handled with the clearness and firm grasp evinced, for example, in the chapters on weather and climate.

We have dwelt at some length on the matter of terminology, for we consider it to be the weakest point of a remarkably powerful book, sometimes obscuring to the reader a meaning which was perfectly clear to the author. We have no objection to the introduction of new terms, and, indeed, consider that it would be an advantage if more were introduced; but they should be carefully chosen to express definite conceptions without ambiguity; they should be very carefully defined, and used no less scrupulously than the terms of mathematics or of seamanship. The exacter handling of language is a desideratum in all literature, and we consider that to use a word which may suggest different ideas to different minds is always wrong, when it is possible to use a word or phrase that can convey only the desired meaning to every reader.

We might call attention to many instances in which facts have been overlooked to the detriment of some particular thesis; but believing that the facts which are cited were intended to be illustrative and not exhaustive, we consider that the real object of the book has been as successfully carried out by the employment of a selection of relative facts as it would have been by a summary of the whole. The references to authorities are somewhat scanty. No reference is

made to 'British Rainfall,' the acknowledged authority on that department of our climate, nor to Scharf's valuable 'Origin of the British Fauna;' but an adequate bibliography would have swollen the work far beyond its very moderate limits of space.

The chapters on racial, historical, and economic geography, and those on Metropolitan and Industrial England, we believe to be by far the best treatment of those subjects that has yet appeared. The account given of the origin of the existing counties is particularly valuable, for the facts have never been brought together before.

The book is illustrated by expressive orographical maps of England, Scotland, and Ireland, a vegetation map, and a generalized geological map on a small scale, all specimens of Bartholomew's best work in clear draughtsmanship and delicate colour-printing. The text is plentifully illustrated by sketch and diagram-maps, in most cases very skilfully treated. One device which produces a happy result is to disregard the conventional orientation, and to place the portion of country dealt with upon the page so as to bring its most prominent features parallel with the edges of the paper without reference to direction; the only possible objection would be obviated if an arrow showing the direction of the meridian were introduced unobtrusively.

If the authors of the remaining works in the series succeed in following the lead of their editor, the literature of geography will be enriched by a wealth of organized learning worthy of the dawn of the twentieth century.

AFRICA.

Rhodesia and the Ophir Problem.*

In our recent notice of Prof. Keane's 'Gold of Ophir' † (March, p. 361), it was pointed out that the main questions associated with this secular problem were twofold: "the original source of the gold of Ophir, and the locality of Ophir

* 'The Ancient Ruins of Rhodesia.' By R. N. Hall and W. G. Neal, with over 70 Illustrations, Maps, and Plans. London: Methuen. 1902.

† The review of this book, which appeared in the March number of the *Journal*, may possibly, though quite unintentionally, convey a wrong impression as to the original value of Prof. Keane's researches, and thus fail to do justice to the really remarkable character of the work, and the wealth of erudition as well as the skill in piecing together the various elements of the question displayed by the author. Apart from the central idea of the work—that Ophir was the distributor, not the producer, of the gold (the originality of which was fully conceded in our review)—Prof. Keane has shed new and valuable light on many interesting points, among which his extension of the Babylonian zodiac to the proto-Aryans, as evidence of the great antiquity of the Zimbabye monuments, and his elucidation of the Himyaritic rock-inscriptions, deserve special mention. Even where the fundamental idea is not absolutely new, as in the case of the early Semitic intercourse with Madagascar, the careful elaboration of the evidence and the abundance of detail never before brought forward, entitle the work to rank as a solid contribution to knowledge, of permanent value to historical and archæological students.—Ed. *G. J.*

itself." Broadly speaking, that book is primarily concerned with the latter question, while Messrs. Hall and Neal's handsome and richly illustrated volume deals almost exclusively with the former. Between them they thus cover the whole ground, and general assent will probably be given to the statement made by the author of 'Ophir' to the authors of 'Rhodesia,' and quoted in their preface, that "the two books should thus be complementary of each other; between us I hope we shall succeed in settling this question in all its bearings once for all." On the one essential point both are indeed in full accord, concluding with almost irresistible force that the golden Pactolus which streamed into Tyre and Jerusalem in Solomonic and even pre-Solomonic times, had its sources in the present Rhodesia, or, taking it in its widest sense, in the whole region (British and Portuguese) between the Zambesi and the Limpopo.

The wealth of evidence brought forward by Messrs. Hall and Neal in support of this conclusion will be received by most readers as a positive revelation, and will have all the more cogency since it is not advanced to serve a purpose, but simply as the result of long and intelligent investigation on the spot. There is no formal discussion of the problems involved; speculation is especially eschewed; and even the main conclusion itself is not stated dogmatically, but rather left to be indirectly inferred from the vast body of facts brought together with rare patience and industry in this first, but by no means final, comprehensive survey of "the ancient ruins of Rhodesia." At the same time, judicious criticism is everywhere apparent. Indeed, the whole work of research has been conducted in a thoroughly critical spirit, and the value of the book is greatly enhanced by the extremely careful and cautious way the various groups of ruins are classed in periods, types, and sequences; the earliest remains (Himyaritic or South Arabian) being distinguished from the later (Phœnician and perhaps post-Mohammedan) and recent (native and Portuguese).

As the readers of the *Journal* are well aware, this region, since the re-discovery of the "Zimbabyes" some three decades ago, had been partly surveyed by several distinguished savants and trained archæologists, notably Mauch, Baines, Bent, Swan, Maund, Schlichter, and White. Hence it might be supposed that little was left to be done by later investigations. But so vast is the field, where upwards of five hundred ruined sites are scattered over a total area of about 115,000 square miles, that the surface had scarcely been more than scratched when Messrs. Neal and Johnson, armed by the Chartered Company with the right of investigating the ruins south of the Zambezi, began their systematic researches in May, 1895, and continued them with little interruption till the close of the century. Their forerunners had, in fact, mostly trodden the beaten path, confining themselves mainly to the "Great Zimbabye" and surrounding district. "The total number of distinct and separate ruins described in their books does not nearly exceed fifty, while many of these are ruins of minor importance, and belong to the later Zimbabye periods." From this some idea may be formed of the vast amount of work accomplished by our authors, who have personally explored and given summary descriptions of no less than two hundred ruined sites—temples, citadels, ramparts, gold-workings, forts, slave-pits—mostly of the early periods, scattered over nearly the whole region. They have further conferred an inestimable service on students by their careful planning of the sites themselves, as clearly shown on the excellent large-scale map accompanying the volume.

The subject is far too vast to attempt any detailed account of the monuments and their contents. It must suffice to say that the general impression conveyed is astounding, and the astonishment is intensified when we read that even now an immense amount of work remains still to be accomplished. This is continually

insisted upon and convincingly proved by the writers, as when they tell us that the Khami ruins, nearly as important as the Great Zimbabye itself, "are practically unexplored. The temple is still buried under the present floors. The original floors are not opened out, nor are the floors on which the gold-smelting furnaces will in all probability be found" (p. 225). And again: "Not a single ruin notwithstanding months of continuous work, can be said to have been exhaustively examined, while many ruins are altogether unexplored, and others are constantly being discovered" (xii.).

If, after a careful study of 'Rhodesia' and 'Ophir,' any lingering doubts should remain regarding the Himyaritic origin of the South African ruins, they will probably be dispelled by a consideration of the character and prodigious development of the ancient terrace-works on the slopes of the Mount Fura and Inyanga uplands in North Mashonaland. Nothing comparable to this arduous agricultural system is elsewhere found, except in the Peru of the Incas, which is beside the question, and in the Sabæan and Minæan highlands of Arabia Felix (Yemen), where the corresponding works, although the parallelism has hitherto passed unnoticed, are not merely analogous, but absolutely identical, both in their general aspect and enormous extent. So true is this that the descriptions given by independent observers of the terraced slopes in both regions might almost change places, as may be seen by comparing the two subjoined accounts:—

Terraced Slopes (Yemen).

"In one district the whole mountain-side, for a height of 6000 feet, was terraced from top to bottom. Everywhere, above, below, and all around, endless flights of terraced walls meet the eye. One can hardly realize the enormous amount of labour, toil, and perseverance which these represent. The terraced walls are usually from 4 to 5 feet in height, but towards the top of the mountain they are sometimes as much as 15 or 18 feet. They are built entirely of rough stone laid without mortar. I reckoned on an average that each wall retains a terrace not more than twice its own height in width, and I do not think I saw a single breach in one of them unrepaired" (General E. T. Haig, *Proceedings* Geographical Society, 1887, p. 482).

Terraced Slopes (Inyanga).

"The extent of these ancient terraces is simply astonishing, and there is every evidence of the past existence of hundreds of thousands of inhabitants. It would be quite impossible to convey any adequate idea of the immensity of labour implied in the enormous number of these ancient terraces. I saw at least 150 square miles composed of kopjes from 100 to 400 feet in height literally strewn with the ruins. A contemplation of the enormous tonnage of stones and earth rudely built into these terraces really left me amazed. Goodness only knows how many thousands of these terraces I did not see. It appears to be abundantly clear that the terraces were for the purpose of cultivating corn or cereals of some sort. The terraces as a rule rise up in vertical lifts of about 2 or 3 feet, and extend backwards over a distance of mostly about 7 to 12 feet. The terraces are all made very flat and of dry masonry, not of hewn stone. On many of the kopjes, commencing at the base, there are, I judge, one hundred terraces before you get to the top" (Telford Edwards, quoted in 'Rhodesia,' p. 353 *sq.*).

The late Dr. Schlichter had already pointed out that the terraces were "pre-Mohammedan." Consequently they fall into line with the other remains credited beyond reasonable doubt to the South Arabian Himyarites and their Phœnician cousins, whose long sojourn in the neighbouring island of Madagascar is introduced as a new factor in the problem by the author of 'The Gold of Ophir.'

Although keeping as a rule closely to their text, the authors of 'Rhodesia' have occasionally permitted themselves a short excursion into other fields, which might perhaps be omitted with advantage in future editions, or else subjected to careful revision. Thus the "Moguedchou kingdom north of Sofala" should be Magdoxo, Somaliland; the first home of the Sabæo-Arabians was not in "Cnaldæa," but unquestionably in Arabia Felix; Marseilles (Massilia) was not a "Phœnician," but a Greek colony; "Durato" and "Durate" should be *Duarte* (Barbosa); Ptolemy (the geographer) did not write "about 200 B.C.," but in the second century of the new era; Zenophon is, of course, a misprint for Xenophon; but the suggested association of the Sabæan goddess *Almaquah* with "the name of Namaqualand," and one or two other strange etymologies, should be carefully eliminated.

GENERAL.

Beazley's 'Dawn of Modern Geography.'*

The first instalment of this fascinating work dealt with what Mr. Beazley describes as the "Dark Age" of geography. He now passes on to the Central Middle Ages. Down to the close of the ninth century Europe had scarcely a glimpse of that marvellous "Dawn" which was destined to illuminate the globe, although the discoveries and conquests of the Northmen had already begun, and these intrepid seamen were not only infesting the coasts of Western Europe, but had settled in Ireland, discovered the Hebrides, the Shetlands, the Orkneys, reached the great island of Iceland, and made their way to Greenland in the west, where they were, in fact, on American soil, and to the neighbourhood of Archangel in the east. Already they had overstepped the limits of the world known to Ptolemy. Yet these voyages produced no change in current geographical ideas; and even that most extraordinary episode in the maritime history of the middle ages—the Norse discovery of the American continent and the exploration of its coasts as far south as New England—passed without leaving more than the faintest of traces on the European mind. One more island had been added to the map of the northern ocean, and that was all. The impulses which produced the geographical revolution arose in another quarter, and moved in the opposite direction. Western Europe directed its attention with ever-increasing interest and persistence to the East, and multiplied its relations with Asia through many channels. Most of the present volume is occupied in tracing the progress of this growing intercommunication under the several forms of Pilgrim Travel, Jewish Travel, Diplomatic and Missionary Travel, and Commercial Travel.

Pilgrim travel, considered as a means of promoting geographical knowledge, had comparatively little importance until the capture of Palestine by the crusaders. It is true that a change appears with the turn of the century after A.D. 1000, when pilgrims began to be much more numerous, and the threatened interruption of the means of access to the holy places served as a pretext for the ferment which

* 'The Dawn of Modern Geography.' Part ii. A History of Exploration and Geographical Science from the Close of the Ninth to the Middle of the Thirteenth Century. By C. Raymond Beazley, M.A., F.R.G.S., Fellow of Merton College, Oxford. London: John Murray. 1901.

culminated in the first crusade. But the great influx of pilgrims began with the establishment of the Frankish kingdom of Jerusalem. Among these Saewulf of Worcester, Abbot Daniel of Kiev, Adelard of Bath, and the Norse King Sigurd are noteworthy, although the pilgrim, as such, contributed little or nothing to the actual stock of geographical information, and the conquest of the holy places was chiefly important as affording a stepping-stone in the direction of the remoter East. Jewish travel in the East assumed a wider scope, both in the ground actually covered and in the objects pursued by it. The interest of the Jew extended far beyond the Holy Land. It embraced Syria, Mesopotamia, and the tombs of Ezekiel and Daniel, the prophets of the Captivity who were still honoured by the Moslems; it impelled him to seek out and maintain communication for commercial purposes with those of his race who were settled in Persia. The Jewish merchant, Benjamin of Tudela, reached the head of the Persian gulf, and his well-known narrative familiarized Europe with the sea-route to Ceylon and China. He was followed by Petachia of Ratisbon and others of less note, whose journeys Mr. Beazley passes over lightly, and proceeds to discuss the more important travels of the missionaries and diplomatists who, in the thirteenth century, penetrated Central Asia with the view of conciliating the Mongol hordes who threatened Europe. Two of these, Carpini, who went as the Pope's legate, and Rubruquis, an emissary of King Louis IX. of France, have left accounts of their adventures which rank among the most important documents of geographical history. Rubruquis, starting eight years later than Carpini, travelled by way of the Black sea, crossed the Volga and the Ural mountains, reached the Great Khan's court, and brought back an immense store of information about the geography of Central Asia and China, and the customs, languages, and religions of their inhabitants. The report had gone forth in Europe that the Tartars were little attached to their primitive idolatry, and not favourably disposed towards Buddhism and Mohammedanism. Rubruquis found Nestorians and Armenians hanging about the Khan's court, promising him the dominion of the world if he embraced Christianity. The impression they had produced was a bad one, and Rubruquis was unable to improve it. He brought back to Louis, whom the Great Khan regarded as a prospective vassal anxious to secure his favour, a rambling letter, breathing nothing but a haughty and fanatical sense of his own power, and of the superiority of the Tartars to all other races on the globe. The mission was a failure, but Rubruquis had done something to bridge the gulf between the West and the far East, and to prepare the way for travellers like Marco Polo, whose descriptions, at a later date, made Tartary, China, and the Eastern islands almost as familiar to Europeans as Europe itself.

The chapter on Commercial Travel deals with the mercantile enterprise carried on with the East by Constantinople and the great maritime republics of Italy, especially during the crusading period. So long as they lasted, the Christian states, established by the crusaders in the Levant, formed new bases for Western trade, while they seriously impeded Moslem intercourse between East and West. The kingdom of Jerusalem commanded the land routes connecting Egypt and Africa with Western Asia. With Petra in the desert, and Elath on the Red Sea, in Christian hands, the produce of India and the far East found its way easily to the European merchant, while the markets of Aleppo and Damascus, Mosul and Bagdad, were rendered more accessible. Even after the principalities of Jerusalem, Antioch, Edessa, and Tripoli had fallen into decay, European enterprise was actively pushing its way farther and farther into Asiatic lands. But with their complete extinction, says Mr. Beazley, "the old difficulty of a hostile and almost impenetrable Islam once more confronted the European nations along the coast-

line of Syria." If not a direct cause, this state of things at least indirectly contributed to the shifting of maritime enterprise to the other end of the Mediterranean, and to schemes for reaching India and the farther East by sailing out through the strait of Gibraltar. Mr. Beazley's concluding chapter deals with geographical theory and description during the central middle age. Foremost among the geographers of the time stands the emperor Constantine Porphyrogennetos, whose treatise 'On the Public Administration of the Empire' not only minutely describes the empire itself with its vassal states, but abounds in information about the barbarian regions to the north and east. After devoting nearly fifty pages to an analysis of this extremely interesting document, Mr. Beazley passes on to Adam of Bremen, the first pioneer in the long series of German geographers, and concludes his volume with an examination of the extant maps of the period, the oldest of which, the 'Anglo-Saxon' Map of the World, drawn by an Irish monk, and now in the British Museum, he attributes to the time of Archbishop Sigeric of Canterbury (992–994). The photographic facsimiles of this, and of the sixteen other contemporary maps, including four maps by Matthew Paris—the 'England,' the 'World Map,' the 'Itinerary,' and the 'Palestine'—will furnish an abundant feast to the numerous amateurs of historical cartography.

E. J. Payne.

Prof. Ratzel's Comparative Geography.*

The scope and bearing of Prof. Ratzel's new book cannot be fully understood from the first volume. In the preface he refers to it as a "Comparative Geography" in Ritter's sense of the term, dealing, that is to say, with the interrelations of the phenomena of the Earth, and therefore looking at the general rather than the special aspect of geography. The work is not a student's text-book like Wagner's 'Lehrbuch'; it partakes rather of the character of Reclus' 'La Terre,' being written apparently for the intelligent general reader sufficiently interested in the subject to attack a considerable mass of printed matter, but not requiring the aid of frequent references to authorities. In fact, at the first inspection, 'Die Erde und das Leben' shows a freedom from footnotes that would be surprising did the preface not promise a list of works consulted in the second volume.

The portion of the work now before us gives a brief but luminous summary of the history of geography, turning over the familiar facts with the ease and freshness that only a specialist leading up to his special study can command. Then follows an account of the Earth as a planet and as a physical body, succeeded by chapters on volcanic phenomena, the movements of the Earth's crust, and the origin of mountains. The remaining two-thirds of the volume are devoted to what we may call physical geography in the particular meaning of the word.

Land and water, islands, coast-lines, geological processes, and land-forms are handled with an absence of technicality and a literary grace that we do not always find in German geographical works, but there is no want of precision as to facts. In discussing the various features, reference is made in many cases to their influence on human movements, and the broader human interests which unite all intellectual studies are not forgotten. This aspect of the subject will be developed more fully in the second volume, which will deal with the oceans and the atmosphere, and culminate in Prof. Ratzel's special sphere of Life and Man.

The illustrations are very numerous, and almost all strikingly good, the clear sketch-maps as well as the photographs. A series of coloured plates is an attractive

* 'Die Erde und das Leben.' Eine vergleichende Erdkunde von Prof. Dr. Friedrich Ratzel. Erste Band. Leipzig und Wien: Bibliographisches Institut. 1901.

feature, and so is the simple but beautiful design of the binding. We trust that the second volume will be provided with a full index, and we venture to hint that the list of works consulted might be more carefully considered from the points of view of selection and arrangement than that given on p. 66.

H. R. M.

THE MONTHLY RECORD.

EUROPE.

Ingleborough.—Few maps of the Ordnance Survey show more interesting features than Nos. 50 and 60 of the Hawes and Settle districts. Prof. Hughes of Cambridge has a valuable account of the physical geography of the Ingleborough neighbourhood in the *Proceedings of the Yorkshire Geological and Polytechnical Society* (vol. xiv. pp. 125–150). He says that he knows of no district in which the ordinary and exceptional operations of denudation can be better studied. It illustrates remarkably the effects of "the condensation of the moisture of the winds on the cold rocks working where no rain can reach; the action of water more or less charged with acids on the limestones; the fantastic forms which are thus produced; the effect of this action on a larger scale in the formation of pot-holes and of underground channels and of valleys by the falling in of caves; the breaking-up of great masses of jointed rock under the influence of frost and the masses that in the thaw are carried over the frozen snow that fills the place where the talus should rest, and form crescentic masses lying some way in front of the cliff; the cutting back of gorges by the removal of block after block, first detached by complex denudation, then lifted out of their bed by the hydrostatic paradox and hurled over the edges of the cliff."

The Cheddar Gorge.—In the February number of the *Geological Magazine*, Dr. C. Callaway calls attention to the zigzag course of the Cheddar gorge as almost certainly due to the jointing of the carboniferous limestone through which the river there flows. This is traversed by two systems of joints, apparently nearly vertical, and intersecting approximately at a right angle, the stone readily breaking away, when quarried, in cubical blocks. That the course of the gorge is due to these joints is supported by the fact that the marked zigzags cease at the end of the gorge, just where the limestone gives place to the Trias, in spite of the more gradual fall in the river-bed during its passage across the latter formation. Dr. Callaway shows that the explanation will hold equally well whether the gorge is supposed to have been cut by a stream flowing above ground or below the surface, though he inclines to the latter view of its mode of origin.

Rainfall Maps of Brandenburg and Pomerania.—The most recent addition to Prof. Hellman's series of rainfall maps of northern Germany, which makes a gradual progress westward from the extreme east, includes the provinces of Brandenburg and Pomerania. The map shows the average rainfall for the ten years 1891 to 1900, a period which comparison with the long-period average of a few stations within the area shows to approximate very closely to the mean. Speaking generally, the greatest amount of rainfall is recorded on the eastern, southern, and western boundaries of the district represented, while the smallest occurs near the middle, in the valley of the Oder. The short paper which accompanies the map deals chiefly with the variations of yearly amounts from the mean, and with the frequency of occurrence of heavy falls of rain. It appears that the average rate of fall per minute is twice as great for showers lasting under an hour, and four times as great for showers lasting less than a quarter of an hour, than for steady rain lasting over three hours. The map is based on the records

of one hundred and eighty stations, employing gauges of 200 square centimetres' area, placed one metre above the ground.

The Limits of the Visibility of Land in the Mediterranean.—It has lately been pointed out by Dr. L. Henkel in a short article in *Petermanns Mitteilungen* (1901, No. 12), that, apart from the nautical charts which show the limits of visibility at sea of the various forms of warning lights, no attempt has yet been made at a cartographical representation of such limits of visibility in the case of ordinary landmarks, in spite of the acknowledged influence which the presence or absence of land-masses visible to a great distance must have exercised on the early history of navigation. As a step in this direction, he has constructed an interesting map of the Mediterranean, on which the water-areas from the surface of which no land can be seen are shown by a distinctive tint. The main factor in the question is, of course, the altitude of the principal mountains adjacent to the coast-lines of the sea in question, and Dr. Henkel begins by drawing up a table of these. Where information as to the altitude of the coast-lines is wanting or imperfect, as in the case of Tripoli, he has been forced to depend upon rough estimates. One unbroken area out of sight of land occupies the southern part of the Eastern Mediterranean from the Little Syrtis to beyond the delta of the Nile, while smaller areas occur in the Sardinian, Tyrrhenian, and Black seas, and even in the Sea of Azov. Owing to the generally high altitude of the South European lands, the limit of visibility is pushed a long way south of their coast-lines, and neither in the Ægean nor the Adriatic is there any point from which some land cannot be seen. On the other hand, the limit runs much closer to the African coast, especially in the eastern half.

ASIA.

Dr. Sven Hedin's Journey across Tibet.—Letters received in Sweden from Dr. Hedin, including one addressed to King Oscar and published in the Stockholm *Dagblad* for January 31 last, give some further details of the explorer's march across Tibet during the latter half of 1901, and his unsuccessful attempt to reach Lhasa disguised as a Buriat pilgrim. It will be remembered that Dr. Hedin left Charklik, south of Lob Nor, in May of last year, intending to cross Tibet in a diagonal direction to the neighbourhood of the sources of the Indus. His caravan consisted of thirty-nine camels and about an equal number of horses and mules, besides donkeys, sheep, etc. Besides the four Cossacks of his escort, his party included a Mongol lama and twenty-four others, mostly inhabitants of the Lob Nor region. Crossing the Arka (Akka) Tag and other high ranges, Dr. Hedin arrived within fourteen days' journey of Lhasa, and then, leaving the bulk of his caravan, which had already dwindled considerably in size, pushed on (July 27) with the lama above mentioned, and a Buriat, in the direction of the sacred city. The small party was attacked by robbers during the first night, and several of the best horses were stolen, so that it was found necessary to keep a constant watch, each of the three members of the party taking his turn in succession. On the eighth day Dr. Hedin was stopped by Tibetan horsemen, and a few days later received a visit from the governor of the province, who firmly vetoed the attempt to visit Lhasa, but was in other respects friendly, causing the stolen horses to be restored. Towards the end of August the small party regained the camp in which the caravan had been left, and the march was resumed in a direction somewhat west of south, which brought the party to Lake Nakchang-tso.* A force of

* The north-west portion of Lake Garing, or Gyaring (Zilling of Littledale), in 89° E., is called by Bower Naksung-Satu. According to Grenard, the Tibetan department of Nagchang extends from about 86° to 88° 30′ E., while a district "Nakchang" is placed by Mr. Littledale between 85° and 86° E.

Tibetans was again encountered, which dogged the travellers' footsteps in order to prevent any renewed attempt in the direction of Lhasa, and only took its departure when the caravan was well on its way to Ladak. As already recorded, this was finally reached in the middle of December last.

The Aral Sea.—The interesting periodicity of changes of level in this lake, which was revealed by the last Aral expedition of L. S. Berg, has already been mentioned in these pages. During the years 1848-1880 the level of the lake was undoubtedly sinking, and the rate of desiccation was estimated by Dorandt, in 1875, at nearly 3 inches each year. However, it appears from L. S. Berg's explorations that since 1880 the level of the lake has been rising, the total rise being about 7 feet (2·05 metres) for the last ten years. A similar rise of level has been noticed, for the last twenty years, in Lakes Tenis and Kurgaljin, situated 530 miles north-east of Lake Aral, and in Lakes Denghiz, Teke, and Kyzyl, 270 miles north-east of Aral, since 1894–95. In an article published in *Petermanns Mitteilungen*, to which reference was made in the *Journal* for November last (p. 531), Prof. Woeikoff showed that the above changes of level are very well explained by the variations in the annual quantity of precipitation, such as appear from meteorological observations made at Barnaul, in West Siberia, where we have the longest series of pluviometric observations in Asia, for the last sixty-two years. Woeikoff's averages run as follows:—

	Millimetres.	Inches.		Millimetres.	Inches.
1838-42	332 ...	15·04	1873-77	280 ...	11·02
1843-47	275 ...	10·83	1878-82	380 ...	14·96
1848-52	254 ...	10·00	1883-87	441 ...	17·36
1853-57	213 ...	8·39	1888-92	489 ...	19·25
1858-62	165 ...	6·50	1893-97	451 ...	17·76
1863-67	138 ...	5·43	1898-99	484 ...	19·05
1868-72	223 ...	8·78			

It appears from these figures that the fluctuations in the precipitation are very considerable, and that the maximum quinquennial average is nearly two and a half times greater than the corresponding minimum. There is also a marked periodicity, the length of the period being probably about fifty-five years. We now learn from a communication made by General Gedeonoff to the Turkestan Geographical Society at Tashkend in December last, that the same periodicity in the precipitation is apparent in the observations made at Tashkend since 1872, as may be seen from the following figures:—

	Millimetres.	Inches.		Millimetres.	Inches.
1872	194 ...	7·64	1888-92	361 ...	14·21
1874-77	242 ...	9·55	1893-97	381 ...	15·00
1878-82	342 ...	13·46	1896-900	389 ...	15·31
1883-87	325 ...	12·79			

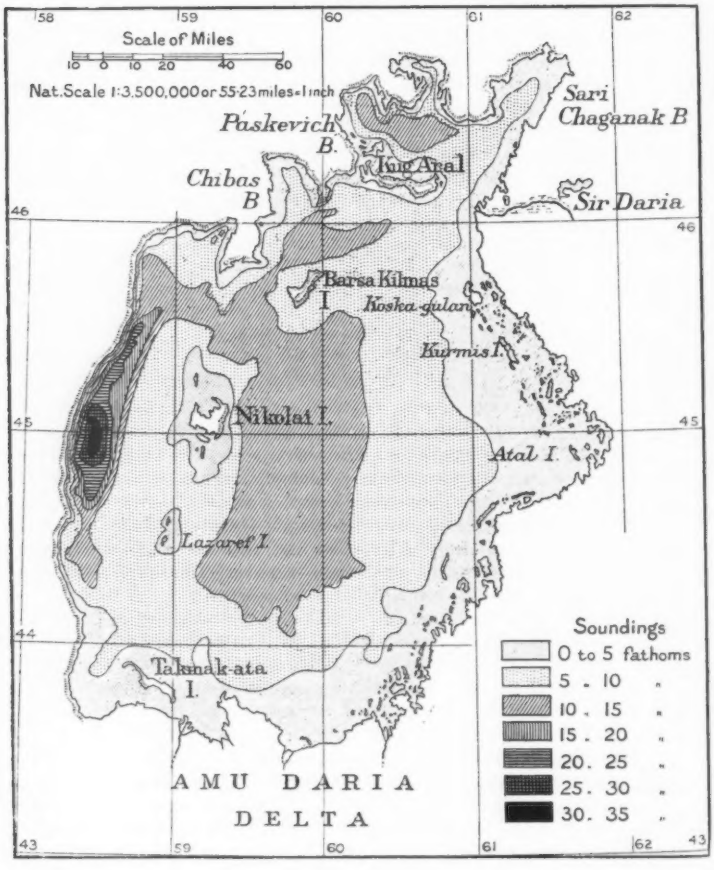
The oscillations are thus analogous to those noticed at Barnaul. It must also be remarked that the oscillations in the levels of the lakes seem to be fifteen years behind the oscillations in the precipitation. The communication made to the same society by L. S. Berg about his work in 1901, on board the yacht *Orion*, was most interesting. The fact that he found the geodetic mark made by Tillo in 1874, and that this mark was now 1·21 metre lower than it was then above the level of the lake, has already been mentioned in these pages. Berg's observations on the changes of temperature and salinity will, we hope, be continued. The specimens of the plankton which he collected have been studied by Prof. Zernoff, who has found among them quite a number of species which have lately been

found by Sars as characteristic of the Caspian fauna. Such are the Cladoceræ: *Cercopagis tenera*, *Evadne producta*, *E. anonyx*, *E. camptonyx*, and the Crustacean *Diaptomus salinus*. Dredging has, as in previous years, brought up only the following well-known forms: *Cardium edule*, two species of *Dreyssena*, *Adacna vitrea*,

ARAL SEA.

Hydrographical data from the surveys by Berg and Molchanoff.

1900.



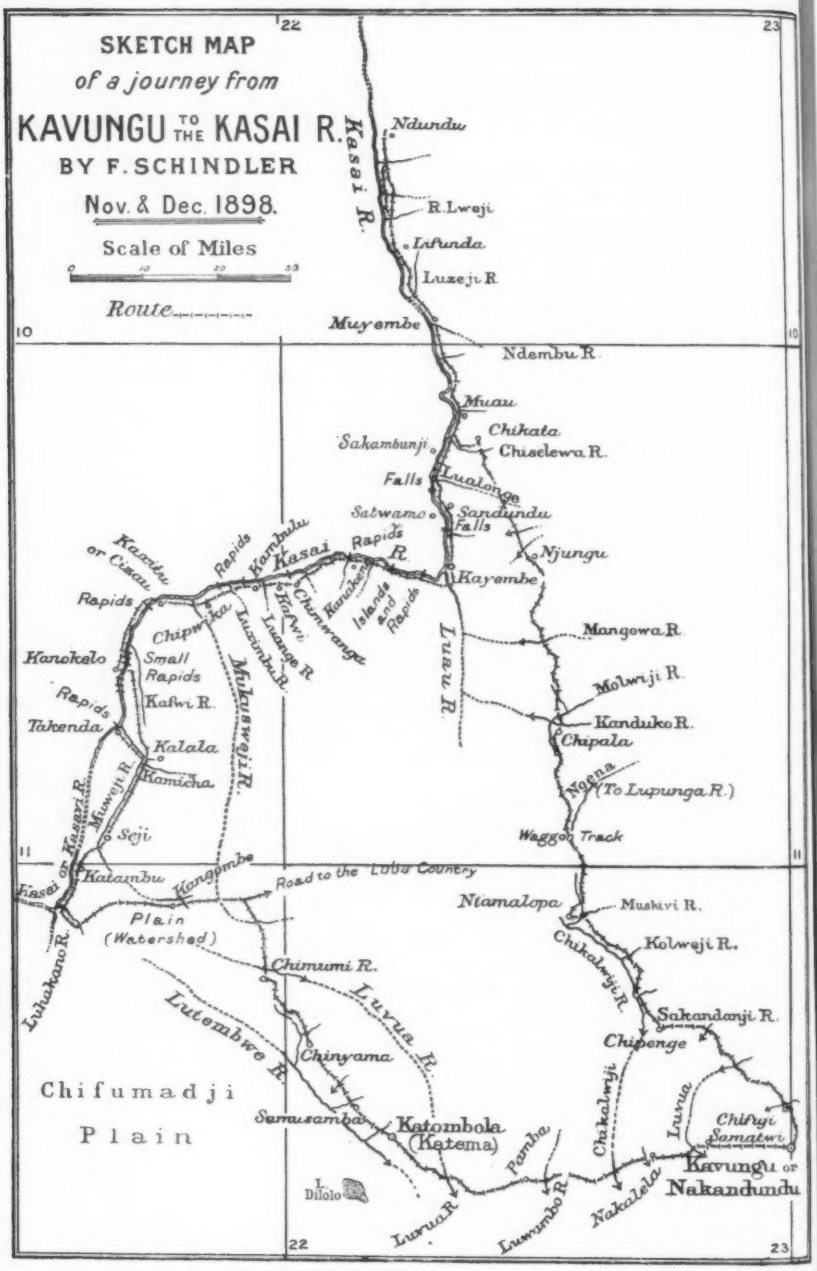
Hydrobia stagnalis, two species of *Gammarus*, and larvæ of both *Chironomus* and an Oligochetes worm. Large collections of plants, as also of specimens of termites, two new species of lizards and snakes, and so on, were made, and the society has decided to continue the exploration during the coming summer as well. The results

of the hydrological observations of Berg's expedition, as also of Molchanoff's survey of 1900 at the mouth of the Syr, are embodied in the accompanying map, which is a reduced copy of the map published at Tashkend, on the scale of 17 miles to the inch.

AFRICA.

The Upper Kasai.—The accompanying sketch-map (see next page) is based on a route-survey with prismatic compass carried out in 1898 by Mr. F. Schindler, one of the missionaries who have been at work for the last fifteen years in the interior of West Central Africa. It adds somewhat to our knowledge of the upper course of the Kasai, which has generally been crossed at right angles by travellers in this region, and has rarely been followed for any long distance from south to north. It will be seen that the course of the river in this section differs considerably from that shown on existing maps, especially in the two sharp elbows, with a west-to-east stretch between them, which occur in about 10° S. Mr. Schindler's journey, which was undertaken mainly with a view to testing the navigability of the Kasai in this section, was made in the rainy season, and the difficulties of the march were much increased on this account, various parts of the country being flooded at the time; much difficulty was also experienced in obtaining porters. From Kavungu or Nakandundu (Nana Kundundu of Arnot and others) the route lay west to the village Katombola, the successor of the Katema visited by Livingstone and Arnot, and thence north-west parallel to the Lotembwe to the trade route from Bihe to the Luba country. The Kasai was struck at the bend a little south of 11°, where it is joined by the Luhakano from the Chifumaji flat. Two rapids were reported higher up the river, at one of which, near Muhumbo, the rocks are said to form a natural bridge. The river was soon left for a time, as there were said to be no villages on its banks. Except at Kangombe, on the Bihe trade route, population had been sparse since leaving the Lotembwe; but on the Muweji, a tributary of the Kasai, there was a fairly dense population of three distinct tribes—the Va-Mbunda or Va-Luenu, the Va-Chiyoko or Va-Chibokwe, and the Va-Lunda, each speaking its own dialect. Further on, too, villages were frequently met with along the Kasai, though often placed at a little distance from the actual bank of the river, so that the paths which join them are not close to the water. Towards the north the villages were generally larger than those of the Va-Lovale. There was little demand in these regions for anything but salt, of which there is great scarcity, as the Bihe caravans do not pass this way. The Kasai was much broken by rocks and rapids, rendering navigation impossible for the most part. It gradually increased in width, sometimes containing islands, and its well-wooded valley at times presented a lovely sight. The Luau and Ndembu rivers, which enter the Kasai on the right, had both to be crossed in boats. A little below the mouth of the former are the Sandundu falls, visited by Captain Lemaire. In about 10 10′ S., the village of Sakambunji, which has figured on our maps since the date of Graça's journey in 1843, was seen on the opposite bank, and some distance lower down, Lifunda or Difunda, the crossing-place of Pogge in 1876, was passed. The lowest point reached was the village of Ndundu, whence Mr. Schindler was forced to turn back, as his followers were frightened by reports of a war camp of the Vafchibokwe—great slave-raiders—two days ahead. The return journey to Nakandundu was made by an almost direct route, leaving the Kasai near Sakambunji.

Positions fixed by the Marchand Expedition.—In a series of articles lately published in *La Géographie*, Naval-Lieut. A. H. Dyé gives an elaborate discussion of the methods and results of the astronomical observations taken by himself and M. Germain during the course of the Marchand Expedition across Africa. An unusual amount of care and attention was devoted to these observations,


SKETCH MAP
of a journey from
KAVUNGU TO THE KASAI R.
BY F. SCHINDLER
Nov. & Dec. 1898.
Scale of Miles
Route
22
23
10
11
Kasai R.
Ndundu
R. Lweji
Lifunda
Luzeji R.
Muyembe
Ndembu R.
Muau
Chikata
Sakambunji
Chiselewa R.
Falls
Lualonge
Satwamo
Sandundu
Falls
Njungu
Kasai R.
Rapids
Kayembe
Kasaidu or Cisau
Rapids
Karubulu
Rapids
Kanakelo
Islands and Rapids
Lueki R.
Mangowa R.
Molwiji R.
Kanduko R.
Chipala
Ngena
(To Lupunga R.)
Waggon Track
Chipuika
Kiavi
Luange R.
Luzumbo R.
Mukuswezi R.
Kanokelo
Small Rapids
Kafwi R.
Rapids
Takenda
Kalala
Kamicha
Kasavi R.
Muweji R.
Scji
Kasai or Kasavi R.
Katambu
Kongombe
Road to the Luba Country
Plain
(Watershed)
Luhakano R.
Ntamalopa
Muskivi R.
Kolweji R.
Chikalweji R.
Chimumi R.
Luvua R.
Lutembwe R.
Sakandanji R.
Chipenge
Chinyama
Chifumadji
Plain
Samasamba
Katombola
(Katema)
Chikalweji
Luvua
Chifwi
Samatwi
Pamba
L. Dilolo
Luvua R.
Luzumbo R.
Nakalela
Kavungu or
Nakandundu

and the results are of much importance for the mapping of the section of tropical Africa traversed by the expedition. The writer discusses in turn the general question of the most suitable instruments for such observations and their mode of use, the elimination of the errors of the instruments, and the special methods adopted for the determination of latitudes, of the local time and its transport from place to place, and of Paris time by occultations of stars by the moon, and other less exact procedures, the relative accuracy to be expected from each being clearly brought out. The value of the results is thus greatly enhanced by the facilities given for checking the precision of any particular value. The section dealing with the determination of longitudes is naturally that of most interest. Owing to the rare occasions on which the method of occultations could be employed, all the stations within a given region were as far as possible connected by the transport of local time, which, as the writer points out, gives specially good results during river voyages; while certain points in each region were fixed by absolute methods. Thus, on the upper Ubangi, the difference of longitude between all the important stations was fixed by the transport of time in closed circuits, while the absolute longitude of Mobaye and Wango was fixed by occultations. Other groups of positions treated in the same way were those of the Mbomu, the Swe, the Bahr-el-Ghazal, Nile and Sobat, and Abyssinia, the principal station in the last-named being Addis Abbaba, the longitude of which, as already made known, was found to be 36° 24′ 10″ E. of Greenwich. The table given by Lieut. Dyé includes about seventy-five positions, the fixing of which involved the observation of more than 2250 altitudes of the sun and stars, or an average of thirty for each station.

The Past History of Tanganyika.—In the last number of *Petermanns Mitteilungen* for 1901, Dr. Ernst Stromer discusses the question, as to which so many divergent views have already been expressed, whether we are justified in concluding that Tanganyika represents an old arm of the sea—a "Relikten-see," according to the German terminology. While hesitating to express a decided opinion as to the past history of the lake, he holds that Mr. Moore's view—based on the halolimnic fauna brought to light within recent years—that it is a remnant of an old arm of the sea which, in Jurassic times, reached from the west to the very centre of the continent, is not supported by geological facts, and is, besides, open to other objections. After summarizing our present knowledge of the sedimentary formations of Central Africa, he shows that, while in Jurassic times a considerable part of the East African coast-lands was covered by the sea, there is absolutely no evidence that such was the case in West Africa, either on the coast or in the interior, while the Jurassic period is just that in which Neumayer has supposed a land connection between Africa and South America to have existed. He considers it unlikely that the great change of conditions which must have followed a separation of Tanganyika from the sea and the gradual freshening of its waters should have failed to change the character of the halolimnic organisms, and is inclined to regard these rather as an instance of convergent development, such as has been considered possible in the case of other widely separated forms of life. The freshwater forms in Tanganyika may, he considers, be the result of a recent immigration, it being not improbable that the lake remained quite isolated from other waters of Central Africa until recent times.

Egyptian Irrigation and Surveys in 1900.—Sir William Garstin's annual report for 1900 on the Egyptian Public Works Department contains, as usual, full details of the progress made during the year in matters connected with the irrigation service, including the works on the great dams at Assuan and Assiut, as well as in the operations of the Survey Department. The opening section deals with the Nile supply in 1900, which disputes with that of 1899 the distinction of being

the worst on record. During the early summer the situation was extremely critical; but though temporary relief was afforded by the sudd-cutting operations, which set free some of the water held back on the upper Nile, and by an early rise derived from the Blue Nile and Sobat, the flood as a whole remained an exceedingly poor one, little or no supply being received from the upper Nile region, where the rainfall had been extremely scanty. That the difficulties arising from a practical failure of supply in two successive years were successfully coped with is greatly to the credit of the Irrigation Department. As regards the surveys executed in 1900, under the superintendence of Captain Lyons, we are told that the minor triangulation of the Fayum was completed, together with a considerable proportion of the major triangulation in the provinces of Dakahlia and Kaliubia, where the minor triangulation was also commenced at three points. In Menufiyeh province the theodolite traverse for the main portion of the chain survey was completed. Good progress was made with the revenue surveys, while the principal work done by the staff of the Geological Survey was the compilation of the results of the field work carried out in previous years, and preparing them for publication. A commencement was made with the survey of the Cataract region, south of Wadi Halfa, which is estimated to require three years for its completion. A trial boring for water at Kafr Dawar, with a view to the possible supply of Alexandria from a subterranean source, gave no satisfactory results. The Meteorological Department has steadily extended its operations, and results of much practical value have been obtained. During the year the heavy work on the new Egyptological Museum was completed, and it was hoped that the transfer from the existing museum at Gizeh would be carried out early in the present year.

AMERICA.

Proposed Relief-model of the United States.—We learn from the New York *Evening Post* of March 12 last, that a project has been set on foot in Washington for the construction of a model of the United States on the scale of 1 : 25,000. This is not the first time that the idea of such a model has been mooted, for several years ago a scheme was under consideration for the construction of an out-of-door model on the Potomac flats. It has been urged, however, that the coarseness of workmanship required to render the model proof against climatic influences would detract from its value. It is therefore proposed to place the model in a low but well-lighted building, some 800 feet long, and half as much wide, and it is thought that the scale mentioned, which corresponds with one of about 2½ inches to the mile, would permit the representation, not only of the relief of the country in true proportion, but of natural features, such as forests, swamps, watercourses, etc., as well as the products of human activity, such as highways, bridges, railways, buildings, etc. To facilitate the keeping of the model up to date, the whole would be divided into sections of standard size, any of which might be corrected or replaced when necessary, and it is also suggested that duplicates of the sections might be sold for educational purposes. The project has not yet advanced beyond the embryo stage, but there can be no doubt that, if carried out, the result would be most interesting and instructive.

Changes in the Mississippi Flood-level.—In an appendix to the voluminous report of the Mississippi River Commission, issued annually in the Report of the Chief of Engineers, U.S. Army, Major G. M. Derby discusses the question of certain changes in flood-heights in the Fourth river district, making interesting deductions as to the precise way in which engineering operations have affected the flow of the river. He points out that, while the study of the relations of gauge-heights is apt to be unsatisfactory owing to the number of variables in the problem, there is a certain

stretch on the lower Mississippi which presents exceptional facilities for investigation. This is the 200-mile interval between the mouth of the Red river and New Orleans, which is practically free both from the influence of tide (felt at the next gauge below New Orleans) and from disturbances due to tributaries or outlets. During the flood of 1897, which broke the high-water record at every gauge in the district, Major Derby was surprised to find that the first gauge to exceed its record was the lowest (that at Fort Jackson), the next that at Carollton, and so on up the river to Red river landing, where the record was not exceeded until sixteen days after such had been the case at Carollton. When the Carollton gauge reached its former maximum, that at Red river landing still marked 1·6 feet below the previous greatest height. These facts were of interest as tending at first sight to show that a raising of the bed of the river had taken place at the lower stations, as has so often been claimed as a natural result of levee-building. Having shown, from observations of other flood-waves, that the phenomenon was not an isolated one, but that a progressive change in the regimen of the river has actually taken place, Major Derby considers in turn the three causes to which the change must be due. He shows that it is not a result of a filling up of the bed of the river below, for no increase in the flood-height at Carollton has been observed during minor flood-waves, where the operation of this cause would be proportionally more noticeable. Neither is the change due to the closure of crevasses by which the water formerly found an outlet, for below New Orleans none have been closed within the last thirty years which drew water from the river below a full-bank stage, at or near which it is shown that the phenomena occur. Above the Carollton gauge no low-level crevasse has been closed since 1887, since which date the change alluded to has continued to progress. The third and only remaining explanation, which must therefore be the true one, is that an increase in the carrying capacity of the river between Red river landing and Carollton has taken place, while it may be shown that this must have occurred at such a height in the bed of the river as to manifest itself only at high stages. This is corroborated by a statement in the report for 1899, according to which there has been a general tendency to a permanent enlargement of the stream above the low-water line. The practical effect of this in the section under consideration is to diminish the high-water slope, so that a flood-wave producing a given height at Carollton will now pass Red river landing at a level several feet lower than would have been the case fifteen or twenty years ago.

AUSTRALASIA.

Prof. J. W. Gregory's Expedition to Lake Eyre.—The expedition under Prof. J. W. Gregory, to which reference was made in our last number (p. 377), returned to Adelaide on January 23 after a very successful journey. An outline of the experiences of the party appears in the Adelaide *Register* for January 24. After starting from Adelaide on December 12, Prof. Gregory engaged a team of nine camels at Hergott, and proceeded along the Queensland cattle road to the Lutheran mission station at Kilalpeninna, where he and his companions were cordially welcomed. The march was resumed by way of Cooper creek to Lake Eyre, collections of fossils, including specimens of the giant kangaroo and diprotodon, being made *en route*. The fossil deposits were traced further west than the point at which they were recently seen by Mr. H. Y. L. Brown, the Government geologist, whose observations are, however, fully confirmed by Dr. Gregory. The Diamantina river was next struck (the route from Cooper creek lying across a waterless tract), and its course followed for some distance, the party then making for the Macumba across rough sandhill country, in which some difficulty was experienced in obtaining water, as the soakages were salt, and only brackish

water could be got. The Peake station was finally reached, and a moonlight march across the Denison range brought the party to Warrina station in time for the fortnightly train from Oodnadatta. Much of the country traversed had for some years been suffering from an unusual draught, but in places—as, *e.g.*, along the the Macumba—the conditions had greatly improved. Stock was, however, very scarce, and even the rabbits were nearly all dead, the ground being in many places strewn with their bones. Several storms, two of them dust-storms, were encountered. The collections made are of much interest, and particular attention was paid to the native names of plants, birds, and animals, so as to identify those mentioned in the folklore of the natives. Prof. Gregory thinks that the quasi-mythical animals spoken of by the aborigines have not been contemporaneous with man in this region.

POLAR REGIONS.

Baron Toll's Arctic Expedition.—In addition to the telegram referred to in the February number of the *Journal*, other items of news have been received at St. Petersburg from Baron Toll's Expedition, which give some idea of the work accomplished since the beginning of last summer (*Petermanns Mitteilungen*, 1902, pp. 23, 48). The *Zarya* was not released by the ice until August 25 (N.S.), when the ship drifted out of Taimyr bay into the open sea. Cape Cheliuskin, quite free from ice at the time, was doubled on September 1, and after approaching Kotelnyi island a north-east course was taken, until the ship was stopped by ice in 77° 9′ N., 140° E. On September 11 Bennett island came in sight, but ice prevented a near approach. Glaciers were, however, seen descending from the snow-clad mountains, which were traversed by deep valleys. After steaming along the ice-barrier to 77° 22′ N., 142° E., it was found necessary to return to Kotelnyi, and the *Zarya* was frozen in on September 24 in Nerpichya bay on its west coast. Here Baron Toll met the auxiliary expedition of Volossovich. During its summer cruise, the *Zarya* passed the supposed position of Sannikof Land without gaining sight of it; so that it must either lie farther north than has been supposed, or have no existence. The Nordenskiöld sea between Cape Cheliuskin and the New Siberia islands was quite free from ice, and the temperature of the water north of the Lena delta was 37°·4 Fahr. A Reuter telegram from St. Petersburg, dated March 22, announces the receipt of further news, despatched from Irkutsk on March 17. From this it is to be gathered that Baron Toll had come south to meet the mail, but that Lieut. Matthiessen had proceeded northward over the ice to study the question of the great ice-hole and its causes. The baron hoped that his supply of coal would permit of further exploration north of the New Siberia islands before returning southward up the Lena to Yakutsk.

The Geology of König Karl Land and North-East Greenland.—During his expeditions in 1898 and 1899, Prof. Nathorst made observations on the geology of these countries, with the assistance of Dr. Hamberg and Mr. J. G. Andersson (*Geol. Foren. Förhandl.*, Nos. 207, 208). König Karl Land was very fully investigated, though one or two points were left undetermined owing to a storm, which forced the party to leave the coast. The strata are almost horizontal, and the mountain-tops are covered with a layer of felspathic basalt, which has done much to preserve the islands from denudation. Erosion has, however, separated Mount Mohn on the Swedish foreland and Haarfagrehaugen on König Karl island from the adjacent plateaus, and Mount Sjögren has been cut off from Mount Tordenskjold. The south-eastern profile of Mount Nordenskiöld shows strata of sandstone tilted very slightly towards the north-east or north. The lowest beds are composed of loose white sandstone, on which lies a yellow or yellowish-brown

sandstone, while the uppermost formation is a very loose white sandstone associated with grey clay-slates. Through this last runs a layer of basalt, whether intrusive or poured over the surface before the upper beds were deposited, is uncertain. From a study of the fossils occurring in the several strata, it may be assumed that a fault runs in a northerly direction, nearly along the axis of the Swedish Foreland, and that the beds have been thrown down on the western side. The same conditions obtain on König Karl island, but there the strata have been thrown down on the *eastern* side of a fault running from Cape Altmann north-north-eastwards. The general sequence of rocks in König Karl Land is as follows: (1) Thick beds of sandstone and clay-slates without fossils; (2) Brown Jura or Dogger (Bath and Kelloway); (3) White Jura (Upper Oxfordian, Kimmeridge, and Volga); (4) Cretaceous (Neocomian). After the lower layer of the Neocomian (a marine formation) was deposited and thrown down, the sea again encroached on the land and obliterated the difference of level caused by the dislocation, so that the upper strata are deposited partly on the Dogger and partly on the Neocomian marine beds. The basalt is of Mesozoic age, as proved by microscopic examination, and by the intercalated bed containing vegetable remains. It is therefore contemporaneous with the basalt of Franz Josef Land, according to Nansen's and Koettlitz's observations. There, too, basaltic mountains predominate, overlying sedimentary strata in the south-west. At the present time there is only one glacier in the König Karl group, Kükenthal glacier on the east flank of Mount Dunér, but many signs of their former existence were noticed. Of a universal glaciation no decided proofs were obtained, and Prof. Nathorst concludes that in all probability König Karl Land was not overwhelmed by an ice-sheet from North-East Land, for rounded blocks of granite and gneiss are not found higher than about 440 feet on König Karl island, to which level or thereabouts the sea appears to have risen. Striated blocks were found only on the lowland near Antarctic bay, and these were striated on two opposite sides. Possibly they were thrown on shore by ice-pressure. In North-East Greenland Prof. Nathorst was unable to make such a detailed geological survey as in König Karl Land, owing to the time and attention necessarily given to the mapping of the geographical features. Nevertheless, he made considerable additions and corrections to the geological map. On the Austrian map the Hekla Hook formation is represented as occurring on the north coast of Franz Josef fiord; but Prof. Nathorst soon perceived that two different formations were present, which he took to be Silurian and Devonian, and this conclusion was subsequently found to be correct. Towards the western extremity archæan rocks appear, consisting of gneiss and mica-schists, with a dip generally to the east and a northerly strike. To the east of it are sedimentary formations, partly at least of Silurian age. The Silurian strata are folded and compressed, sometimes inverted. If the folding had any connection with the formation of a mountain range, it must have taken place before the deposition of the Devonian beds, for the latter are comparatively little disturbed. A later formation, probably Jurassic, surrounds Antarctic harbour on the western shore of Davy sound, and perhaps the Keuper and Jurassic strata extend further, from Hurry inlet. Late eruptive rocks, as already shown by Toula, form a belt along the coast, and several specimens were collected. The whole region bears signs of glaciation. Terraces occur in all places adapted for their formation. Of special interest among Quaternary fossils is the *Mytilus edulis*, which was found at the mouth of Sofia sound and at the head of Franz Josef fjord at a height of not more than 30 feet above the water. Mussels are not found, living, north of 66°, and could not now exist in the fjord, where icebergs are constantly calved and drift about.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

The Bedding, Foliation, and Movement of Glacier Ice.—Prof. Hans Crammer, of Salzburg, who has made extensive observations on the structure and movements of glacier ice, has brought forward a theory explaining the relation of these phenomena, a full account of which will be published shortly. A summary of the chief points to be dealt with in the larger memoir appears in the *Centralblatt für Mineralogie* (No. 2, pp. 103-107, 1902). The structure usually termed stratification or "banding" (*Bänderung*) in glacier ice (see E. Richter, "Die Gletscherkonferenz in 1899," *Pet. Mitt.*, pp. 77-81, 1900; also *Geographical Journal*, xiv. p. 316, 1899) Crammer calls more accurately foliation (*Blätterung*), the stratification being merely the appearance of the foliated structure at an external surface. Attention was first drawn to this point by the American geologist, A. F. Reid, at the International Congress of Geologists, in Paris, in 1900, and again, independently, by Hans Hess (*Neues Jahrbuch für Mineralogie*, Bd. i. pp. 23-34, 1902). Crammer's conclusions have been reached from an altogether different standpoint; they were first announced by him at a meeting of geographers in Vienna in 1901. The different rates of motion observed on a cross-section of a glacier make it impossible to regard its movement as a mere sliding of the mass of ice as a whole; the phenomenon is rather a sliding of one particle over another, or differential motion, which takes place chiefly where the cohesion of the ice "molecules"—the *Körner*, or ice-crystals—is weakest, *i.e.* at the interfaces of the beds originally formed in the *Firn*. The dust deposited on the surface after each fall of snow interposes an extremely thin layer of foreign material which separates the strata of the field ice from one another. This is the primary cause of stratification, and the stratification prevents the growth of the ice-crystals, which is due to subsequent pressure, from extending out of one layer into another. The crystals in different layers adhere strongly to one another only when the temperature is well below the freezing-point, and the observations of Forel, Drygalsky, and Hess have shown that at a distance from the surface the temperature is constantly that of melting ice. Hence the layers tend to glide easily over one another during the whole progress of the glacier from beginning to end.

Capture of Sub-aërial by Subterranean Streams.—In the *Comptes Rendus* for December 2 last, M. E. Fournier gives several instances which show that, in limestone regions, the phenomenon of the capture of superficial by underground streams is by no means so rare as might be imagined. The most important instance cited is that of the source of the Loue, which M. Fournier's researches have shown to owe its water-supply not only to leakages from the Doubs (the connection in this case has been positively proved by the recent fire at the Pernod works, during which a quantity of absinthe was poured into the Doubs), but to similar losses from the Drugeon, which supply the subterranean stream at the pit of Jardelle, and from the closed basin of Arc-sous-Cicon. An example of double capture is thus progressing under our very eyes, and similar phenomena play, M. Fournier thinks, an important part in the evolution of hydrographic networks, and also in the progressive desiccation of high limestone plateaux. The formation of cañons may likewise often have its first origin in this way, their excavation beginning at the lower levels.

The Influence of Rainfall on Commerce and Politics.—Mr. H. Helm Clayton, of Blue Hill Observatory, has an instructive article on this subject in the *Popular Science Monthly* for December, 1901. He cites the works of Wills, Rawson, Maxwell-Hall, and others in comparing rainfall, stock-rearing, or sugar-production, but erroneously ascribes Sir Charles Todd's researches into the relationship of rainfall and wheat to Wills. He shows that in the United States, as we

might anticipate in a country hitherto so largely dependent on its production of food-stuffs and organic raw materials, that "every severe panic has been closely associated with a period of deficient rainfall." The panic of 1856 followed the dry years of 1854–6; that of 1873 came after the drought of 1870–2; that of 1887–95 was accompanied in the severest years of drought, 1893–4, by a panic, and financial depression persisted from 1893 to 1897. He then shows how the elector, ascribing such crises to political action, has turned against the party in power, and so brought about political crises, though we doubt if the change of parties in Britain in 1895 can be primarily ascribed to such a cause as Mr. Clayton suggests. He would explain the retention of power by ministries in Britain, France, Canada, and the United States in recent years as in part at least a function of increased rainfall and increased prosperity. We cordially echo his wish that "some wise benefactor would found an institution purely for research, where all such questions of man's relation to the universe would be carefully investigated by trained investigators, using the well-tried and fruitful methods of science." How far politicians would welcome such scientific study is another question.

GENERAL.

Awards of the Russian Geographical Society.—At its meeting of February 5 the Russian Geographical Society awarded its Constantine medal to K. I. Bogdanovich, the explorer of Central Asia, for his many years' work; the Semenoff medal was awarded to Eduard Suess, for his classical work, 'Das Antlitz der Erde;' and the Prjevalsky medal to the zoologist, Prof. N. A. Zarudnyi, for his last journey in Eastern Persia and previous work in ornithology in the Transcaspian region. The great gold medal of the Statistical section was given to N. Y. Sliunin, for his elaborate work, 'The Okhotsk-Kamchatka Region,' and his general researches into the economic conditions of the Okhotsk and Kamchatka littoral; and three small gold medals were awarded to engineer N. P. Petrovsky, for his article, 'The Tazes or U-di-khe;' the student D. K. Zelenin, for his work 'On the Popular Songs of the Yarensk District;' and M. N. Kosich, for an article on 'The White Russians of Chernigov'—all these works having been published in *Zhivaya Starina* ('Living Antiquities'), the review of the Ethnographical Section of the Geographical Society. The two large silver medals were awarded—the Prjevalsky medal to Prof. Gordyaghin, for his botanical work in East Russia, and the Semenoff medal to A. K. Bulatovich, for his journey to Lake Rudolf. Small silver medals were given to seventeen persons for various minor work made in connection with the Society, chiefly in meteorology.

OBITUARY.

M. Charles Maunoir.

We regret to announce the death of M. Charles Maunoir, honorary secretary of the Paris Geographical Society. M. Maunoir, who was an Honorary Corresponding Member of the Royal Geographical Society, resigned some five years ago the general secretaryship of the Paris Society, a post which he had filled with great distinction for thirty years. He died, after a long and painful illness, on December 22, in the seventy-second year of his age. Himself a scientific geographer in the strict modern acceptation of the term, he could recall the time when geography was, as it were, somewhat of a Cinderella among the sciences. Indeed, it was no small

measure due to his exertions that a true conception was formed in France of the manifold importance of geography. He was one of the first in that country to take a wide and comprehensive view of the scope of geographical science, to realize the value, both from an educational and a practical point of view, of its systematic study, and to set to work to popularize it and give it a proper standing amongst the various branches of knowledge. We need not say how successful have been his efforts in this direction.

M. Maunoir was born on June 23, 1830, at Geneva, where he received his early education. In 1852 he entered the French army, but a year later an accident incapacitated him for active service, and he was transferred from his regiment to the map department of the French War Office. Fourteen years later, in 1867, he accepted the post of secretary to the Paris Geographical Society, and began the work which has made his name so widely known in French geographical circles. At that time the Paris Geographical Society was a learned society in the narrowest sense of the term, "un cénacle d'érudits deliberant." Its membership was small; its work was little known. M. Maunoir at once set himself to remedy this state of affairs and, thanks mainly to his tact and genial personality, as well as to his wide knowledge and masterly conception of the lines on which geographical science ought to be developed, the Paris Society now occupies in France a position very similar to that of our own Society in this country. His *Rapports annuels sur les progrès des sciences geographiques* provide a history of geographical work from 1867 to 1896, of which the value has received wide-spread recognition. M. Maunoir took a particular interest in applied geography, especially in its bearings upon political questions, and the many expeditions which have formed so important a feature in the expansion of France's Colonial Empire always received his warm support. M. Maunoir was an officer of the Legion of Honour, and in 1892 was awarded by the Paris Geographical Society a special gold medal for his services to geographical science. Those who know the work he has accomplished will recognize the loss which that Society—and, indeed, the geographical world as a whole—has sustained by his death; those who enjoyed his personal acquaintance will remember him as one of the most courteous and kindly of men.

Professor Mushketoff.

The Russian Geographical Society and geographical science altogether have sustained a heavy loss by the death of Prof. Ivan Vasilievitch Mushketoff, who has been for the last sixteen years president of the Physical Geography section of the Russian Geographical Society. He was born in 1850, in south-eastern Russia, in the province of the Cossacks of the Don, and received his first education in the lyceum of Novocherkassk. At the age of barely seventeen he was at the university of St. Petersburg, which he joined in its philological faculty; but, happily for science, he soon abandoned philology and entered the Mining Institute. There, during his student years, he made and published his first scientific researches on the diabase porphyris of Volhynia, and in 1873, as soon as he had terminated his studies at the Mining School, he was sent out for exploration work to the Urals, where he discovered and described a formation of arseniated minerals, important for its relations to the distribution of gold. In this same year he published also, in the Memoirs of the Ural Society of Naturalists, a paper on the mineralogy of the Don province, and received his nomination as a mining *attaché* to the governor-general of Turkestan. The six years which young Mushketoff spent in Turkestan, in journeys the importance and extent of which increased every year, was the making of the geologist and geographer. He first visited the

western Tian Shan and Kulja, as also the southern Urals; but from 1877 he extended his journeys to the Alai mountains and the Pamirs, to Lake Chatyr kul; next to Bukhara, Hissar, the Amu, and the Kyzyl kum desert. In 1880 he made a great journey to the Zerafshan glaciers, where he found unmistakable traces of a wide glaciation; and six years later he published a remarkable work in Russian, 'Turkestan,' in which he laid the foundations of the geology of this important portion of Asia. Unfortunately, only the first volume of this valuable work was published, Mushketoff being prevented from finishing it, partly by his new duties as professor at the Mining Institute, and partly by the new interest he took in the Caucasus, after he had made a journey thither for the exploration of its glaciers, mineral waters, and manganese ores. Moreover, since 1882 he became chief geologist of the newly formed Geological Committee, and thus had to devote part of his time to the geological survey of Russia. Besides, a journey to Turkestan, for the investigation of the great earthquake of Vyernyi, involved him in the study of earthquakes, while in 1885 he became president of the Physical Geography section of the Geographical Society. In this capacity he had to take a lively part in all the scientific—meteorological, seismical, geodetical, etc.—work of the society, and, with P. P. Semenoff, in equipment of all the expeditions organized by the Society.

Beside the work on 'Turkestan,' a geological map of the region, which he published in company with Prof. Romanovsky, and numerous smaller papers, Mushketoff published during these years the first volume of a very well-written course of physical geology, and a short course of 'Petrography.' He started also the collecting of materials concerning the earthquakes in Russia, and edited the most valuable work, by Orloff, 'Catalogue of Earthquakes in Russia,' which its author had not been able to publish during his lifetime. Moreover, Mushketoff managed to find time for editing the excellent 'Year-book' of the Geographical Society, which contains a full review of all geographical, geodetical, zoographical, phytographical, ethnographical, and statistical work done every year both in Russia and elsewhere, and having a bearing on the exploration of the Russian Empire. Since 1895, he was also the representative of Russia in the International Committee for the registration of the oscillations of the glaciers, and in this capacity he edited the corresponding observations which were made in the Caucasus and Turkestan. His last work was in the Trans-caspian Steppes, and in discovering the best direction for the tunnel through the main Caucasus range.

During the Congress of Russian naturalists, which took place at St. Petersburg last Christmas, Mushketoff was one of the most energetic organizers, and it was at one of the official festivities that he caught a cold which brought him to the grave. The Russian papers speak with great warmth of the late professor, and insist especially on his personal amiable qualities and the warm interest he always took in the defence of the students, especially during recent disturbances.

A very good short biography of Mushketoff, with a list of his chief works, is given in the thirty-ninth volume of the new Russian 'Encyclopædic Dictionary.'

General M. V. Pyevtsoff.

The Russian Geographical Society has sustained a great loss through the death of General Mikhail Vasilievich Pyevtsoff, the well-known explorer of Central Asia. He was born in 1843, and received his education in a military school, and afterwards at the Nicholas Military Academy of the General Staff. The first fifteen years of his military career, after he had left the Academy, he spent at Omsk, which was then a centre for the exploration of Central Asia.

In 1876, he made a journey in Jungaria, from Lake Zaisan to the Chinese town Gu-chen, during which he did excellent geodetical work, astronomical, magnetical, and hypsometrical. He gave also vivid descriptions of both the desert situated between the Saur mountains and the Southern Altai and the Torguts, the Dungans, and the Tian-shan Chinese. For this journey he was awarded by the Russian Geographical Society a small gold medal.

Two years later, 1878–1879, he made a still more remarkable journey *viâ* Kobdo to Kuku-khoto (Gui-hua-chen) and back *viâ* Urga. The results of this journey, during which 2700 miles of survey were made and twenty-nine points were determined astronomically, were very important, and in 1885 the Russian Geographical Society awarded to Pyevtsoff its Lütke medal. The results of the first expedition were published by Pyevtsoff in the *Memoirs* of the West Siberian branch of the Russian Geographical Society (vol. i., Omsk, 1879), and those of the second were embodied in a work, "Sketch of a Journey to Mongolia and the Northern Provinces of China," in the same *Memoirs*, vol. v., 1883, which is perhaps the best work we have on North-Western Mongolia.

Four years later, in 1882, Pyevtsoff took part in the great survey which was made to settle the boundary between Western China and Russia, and covered 30,000 square miles with his surveys. He also worked out during this survey the method of determination of latitude by means of the corresponding heights of two stars, which was an extension of N. Tsinger's method of determining time by corresponding heights of different stars, and, with the aid of Pyevtsoff's tables, proved afterwards of great value in subsequent expeditions.

When Prjevalsky suddenly died in 1888, at the moment of starting for a new Tibet expedition, Colonel Pyevtsoff was nominated the head of this expedition, and travelled, in company with Roborovsky, Kozloff, and Bogdanovich, during the years 1889–90 in East Turkestan, Northern Tibet, and Jungaria. The results of this expedition, during which more than 6000 miles of survey were made and the aspect of the Kuen-lun was entirely changed on our maps, are well known. They were embodied in three quarto volumes, 'The Work of the Tibet Expedition' (St. Petersburg, 1895–98), which, besides their purely geographical value, are very interesting reading, on account of the descriptions of life in East Turkestan given by Pyevtsoff. For this expedition the Russian Geographical Society awarded him its great Constantine medal in 1892.

Pyevtsoff also published a text-book of mathematical and physical geography. Of his smaller geodetical papers, the following are especially worthy of notice: "On the Determination of Latitudes by the Corresponding Heights of Two Stars," in *Memoirs* of the Russian Geographical Society, General Geography, vol. xvii., 1888; and "Barometric Levelling," in the same periodical, vol. xxix., 1896. An analysis of his work was given in the Annual Report of the Russian Geographical Society for 1891.

Captain Bonnevie.

Captain Törres Bonnevie, our Norwegian agent for the relief ship *Morning*, worked so zealously and so conscientiously for the Society, that his death ought not to pass without notice. Born at Grimstad in 1836, young Törres Bonnevie went to sea at the age of thirteen, and became master of a ship at the age of thirty-one. He was employed for some years conveying emigrants from Norway and Belgium to New York, and during the last years of his sea-service he commanded the steamer *Alpha*, of Christiansand, plying between Antwerp, Norway, and the German ports in the

Baltic. For twenty-eight years, from 1874 to the time of his death, Captain Bonnevie was surveyor to the Norwegian "Veritas" for ports on the southern coast, residing at Laurvik. He thus acquired a very intimate knowledge of the build and requirements of sealing and whaling vessels; and was latterly much engaged in selecting and fitting out ships for polar explorers: the Danish ship, *Godthaab*, the *Frithjof* for Mr. Wellman, the *Capella* relief ship, the *Jason* for the Duke of the Abruzzi, the *Harald Haarfager* for Baron Toll, the *Morning* for us, and the *Hecla* for Mr. Bruce. All valued his services very highly.

Captain Bonnevie was a thoroughly straightforward, honest, conscientious, and zealous agent, and a most kind-hearted man. It is to be feared that he latterly overtaxed his strength, for complete rest was necessary for him. He died on February 26, 1902.

Dr. Emil Holub.

The well-known African explorer, Dr. Emil Holub, died on February 21, 1902 at the age of fifty-four, after a long and severe illness, due to malarial fever acquired in the Zambezi valley. Born on October 7, 1847, at Holitz (Pardubitz) in eastern Bohemia, Dr. Holub studied medicine and natural science at Prague. His interest in exploration was largely the result of a study of the journeys of David Livingstone, and in 1872 he went to South Africa as a doctor on the diamond fields. The first of his smaller journeys was undertaken in February, 1873, when he traversed the southern Bantu region; in November of the same year he visited the Transvaal and the districts immediately to the north. The first journey on a larger scale started in March, 1875, and extended to the Zambezi and the Victoria falls. This expedition was cut short by an accident, but not before extensive scientific collections had been made, which Dr. Holub brought to Europe in 1879, and distributed in 113 Austrian and foreign museums and schools. Four years later he again set out for Africa, accompanied by his wife, with the intention of traversing the entire continent northwards from Cape Town. This plan had to be abandoned on account of the troubles in the Sudan, and instead he undertook a journey to Lake Bangweolo, intending to explore the unknown Matoko and Mashukulumbi countries, and the northern Zambezi region. But at Galulonga, on the Kafue, a tributary of the Zambezi, within sight of the mountain named by him Franz Josef Berg, his camp was attacked and plundered by the Mashukulumbe (August, 1886), and he had to return, having lost nearly all his collections and even his journals. Some time was spent at the mouth of the Chobe, and the collections made at that time form Dr. Holub's most important contributions to science. He returned to Europe in 1887, bringing with him no less than 13,000 objects, which he again distributed in museums and schools, after exhibiting them in Vienna (1891) and Prague (1892). His scientific reports amply testify to the wide range of his observations, and his popular lectures were well known both in Europe and America. His chief published works are: 'Kulturskizze des Manutse-Mabundareiches' (Vienna, 1879); 'The Victoria Falls' (Grahamstown, 1879); 'Sieben Jahre in Südaffrika' (2 vols., Vienna, 1880–81); 'Die Kolonisation Afrikas' (Vienna, 1882); 'Beiträge zur Ornithologie Südafrikas' (Vienna, 1882, in collaboration with von Pelzeln); and 'Von Kapstadt in's Land der Mashukulumbe' (2 vols., Vienna, 1888–90).

CORRESPONDENCE.

The Kinsha River of West China.*

In the *Geographical Journal*, vol. viii. p. 515, reference is made to M. Bonin's discovery, when travelling in the south-west of China, that below the sharp angle made by the Kinsha near the town of Li-kiang, the river (of Golden Sand) makes a wide sweep to the north, joining the Yalung in about 28° N. lat. instead of 26° 35′, as has been hitherto supposed.

In a note on this discovery, it was remarked that M. Bonin did not trace the river continuously during its northward sweep, but that it is to be supposed that he did not fall into the error (otherwise attributable to M. Hosie) of mistaking a tributary for the main stream. The writer adds, "Is it just possible that a bifurcation takes place, such as was hinted at in a neighbouring region by Lieut. Garnier?"†

In a paper on the Yang-tse, published in the *R.G.S. Journal*, vol. xii. p. 229, I adduced some reasons to show that it was unlikely that the Kinsha joined the Yalung at the point mentioned, and I find that in the *Bulletin de la Société de Géographie de Paris*, 1898, p. 395, M. Bonin writes that a mistake had been made owing to "l'interprétation hâtive des renseignements trop succincts que j'avais envoyés."

M. Bonin writes: "À un jour de Yun-ning-tou-fou l'itinéraire passe au dessus du lit du Yang-tse-kiang que toutes les cartes représentaient jusqu'ici comme coulant à près d'un degré, 100 kilomètres plus au sud. Le Fleuve Bleu, en effet, à partir du bac d'Ashi où je l'avais traversé, décrit une immense courbe vers le nord qui n'a été vue par aucun voyageur. Il tourne ainsi autour d'un grand massif montagneux dont les summits (au sud le pic de Li-kiang, au nord le mont Koa-tyu) varient entre 5000 et 6000 mètres d'altitude.

"Les renseignements pris à Tali m'avaient mis sur la voie de cette découverte; elle me fut confirmée d'autre part par les itinéraires des caravaniers qui font la route entre Tat-sienlon et Tali et affirment passer le Fleuve Bleu près de Fong-ko, à un jour et demi au sud de Yun-ning-tou-fou. . . . Quant au cours du fleuve entre le bac d'Ashi et la région de Yun-ning-tou-fou, puis de là jusqu'aux points où il fut coupé par les itinéraires de Francis Garnier et de Hosie, il n'a été dessiné sur la carte ci-jointe que pour mémoire, aucun Européen ne l'ayant reconnu entre ces trois sections. Tout ce que je puis affirmer, c'est que le grand cours d'eau qui coule à un jour de Yun-ning-tou-fou est bien le même que celui que j'avais franchi au bac d'Ashi, c'est à dire le Yang-tse-kiang, Kin-sha-kiang ou Ashi-kiang comme l'appelaient mes caravaniers chinois près de Yun-ning même.

* * * * * * * * *

"Quant au cours d'eau qui descend vers le sud du pic de Li-kiang et que les cartes représentaient comme le cours même du Yang-tse redescendant immédiatement après avoir contourné le pic, c'est en réalité un affluent de droite du Fleuve Bleu qui porte le nom chinois de Pe-shui-kiang."

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* Dr. Jack's map in the March number of the *Journal* may be consulted. It should, however, be pointed out that the route crossing the Kinsha in 26° 15′ N. should have been marked as Hosie's, not Garnier's, the latter traveller having kept to the south of the river until about 101½° E.

† In a subsequent note, which appeared in the *Journal* for May, 1899 (p. 532), we referred to the rectification by M. Bonin, quoted by Mr. Carles in the next paragraph, and showed that it removed the difficulty to which attention had been drawn in the first note.

In the map which accompanies his paper, M. Bonin gives an imaginary sketch of the course which the Yang-tse takes after this immense bend northward, and connects it with the course generally shown on maps a little west of Chin-chiang-kai, where M. Hosie crossed it in 1883.

But if M. Bonin's theory is correct, the bend taken by the river must be even more extraordinary, for, as I mentioned in my paper, Dr. A. Anderson, of the C.I.M., had crossed the Yang-tse by the iron bridge near Li-kiang, where the river is called the Chin-sha, and had struck it again above its confluence with the Yalung, and spoke of its describing an immense curve from the south before joining the Yalung, to avoid a large mountain.

This information has now been supplemented by the journey made by Dr. Jack, of which he gave an account at the R.G.S. meeting of January 13. Dr. Jack, who crossed a section of country between Yung-pei and Li-kiang, which has not, I think, been previously described, states that he crossed the Yang-tse (left to right) by an iron suspension bridge, 5 chains in length, 27 miles west of Yung-pei, at an elevation of 4400 feet, below the mouth of the river which drains Po-lo and Yung-pei, and that the city of Li-kiang was only 16 miles from the bridge, which I presume is the same bridge as that mentioned by Dr. Anderson. If the Yang-tse returns from the point where M. Bonin struck it in its north bend to within 16 miles east of Li-kiang, the curve described by it lacks little to complete a circle.

The existence of such a bend explains the disappearance of the river Wu-liang, which is shown in Dr. Bretschneider's map as well as others as descending from the north of Litang, almost due south, until it joins the Yang-tse, south-east of Li-kiang. This river may be the same as either the "Tua-tze-ho" or the Senji, crossed by M. Bonin between Chung-tien and Yung-ning, which enter the Kin-sha in the upper part of its bend north. Much mystery still attaches to the course of these rivers, as well as to that of the Yalung, and it is to be hoped that the journey made from Wei-si towards Li-tang by Major Manifold and Captains Ryder and Davies in September, 1900, has thrown further light upon them.

I cannot but think that M. Bonin must be mistaken in considering the Pai-shui-kiang to be an affluent of the Yang-tse, for the information furnished both by Lieut. Garnier and by Mr. Hosie tends to prove that the Yang-tse at that part of its course is called by that name. On the other hand, the confusion of names mentioned by Lieut. Garnier may mean that there is yet something further to be learnt about that part of the Yang-tse. It is, unfortunately, only of places here and there that accurate information with regard to the course of the Yang-tse above Ping-shan has been obtained. For the rest, the greater portion of its route, the position shown in maps rests mainly on conjecture.

W. R. Carles.

The Belgian Antarctic Expedition.

Le mars 17, 1902.

Dans le dernier numero du *Geographical Journal*, p. 387, a paru une rectification de M. Pelseneer à l'égard de certaines erreurs que M. Arçtowski a commises dans sa lecture sur l'Expédition Belge Antarctique (*Geographical Journal*, October, 1901). M. Arçtowski a cité mon nom dans son réponse à M. Pelseneer. J'ai été, en effet, quelque peu mêlé aux préliminaires de l'expédition, et je puis affirmer, en ce qui me concerne, que je n'aurais pas donné mon approbation au projet de M. de Gerlache s'il s'était agi d'un simple voyage d'aventure. La commission de trois membres dont je faisais partie et qui avait été choisie dans le sein du Comité Central de la Société de Géographie n'a conclu au patronage de la Société que

parceque dès le début M. de Gerlache insista sur les résultats scientifiques qu'on pouvait attendre d'une expédition antarctique à laquelle il voulait adjoindre des savants qui, à ce moment, n'étaient pas encore désignés. Lorsque le mémoire de M. de Gerlache a été Soumis à la Commission, il ne contenait pas les corrections auxquelles fait allusion M. Arçtowski ("scratched-out words"). Si ces corrections ont apparu plus tard, c'ést la un fait qui pourrait être vérifié au besoin dans les archives de la Société.

JULES LECLERCQ,
Président de la Société Royale Belge de Géographie,
Membre Correspondant de la Royal Geographical Society.

The Sobat System.

Major Austin has now supplied, in his letter printed in the March number of the *Journal*, an explanation which completely removes any doubt as to the correctness of his identification of Wellby's "river 30 yards broad" with the Gelo. The difficulty, to which attention was called in the note in the *Journal* for September last, arose solely from the discrepancy between the latitude of the mouth of Wellby's river as shown on his map and of the Gelo as shown by Major Austin—a discrepancy which, if the former's supposition as to the course of the Ruzi where not actually traced by him had been correct, would have amounted to some 20′. By showing that the Ruzi really makes a sweep to the west below the point where it was left by Wellby, and that the "river 30 yards broad" therefore joins it some 50 miles lower down than was supposed by that traveller, Major Austin has not only removed the difficulty alluded to, but has made it much easier than it had seemed to fit in Wellby's work with that of other travellers.

E. H.

MEETINGS OF THE ROYAL GEOGRAPHICAL SOCIETY, SESSION 1901–1902.

Seventh Ordinary Meeting, February 24, 1902.—Sir CLEMENTS MARKHAM, K.C.B., President, in the Chair.

ELECTIONS:—*Wm. Edward De Winton; James George Hooper; Lieut.-Colonel A. F. Montanaro, R.A.; William Muir; Charles Pharazyn; Jacob Crawford Pharo; William Herbert Purvis; Walter Sydney Howard Smith; Chauncey Hugh Stigand* (*Lieut. 1st Queen's Own Royal West Kent*).

The PRESIDENT: I must refer, first of all, to the loss of the oldest Fellow of this Society, Lord Fitzwilliam—that is to say, our senior Fellow. He had been a Fellow for sixty-five years, and after his death, which happened a very short time ago at a good old age, we no longer have any Fellows who date from the thirties. We have also sustained a great loss, and the country has sustained a great loss, in the death of the Marquis of Dufferin and Ava. Lord Dufferin was not a scientific geographer, but he was a most accomplished traveller, and as President of this Society he was equal to his predecessors and to his successors in his earnest and enthusiastic desire to further the cause of geographical research, and in his profound conviction of the value and importance of the functions that are discharged by the Society. Lord Dufferin was always genial, he was a most charming colleague, and we were deprived of him very prematurely when he had to go as Ambassador to St. Petersburg. After that he was so constantly in great public

employments that he had very little time to attend to geography; still, he was always anxious to help us in our work, and when I saw him at Rome he was full of interest in the explorations that were then going on. The very last time I spoke to him he conversed with me, with great interest, on the very subject which is going to occupy us this evening—the Antarctic Expedition. You may rely on the accuracy of what I am going to read to you, for it is copied from the letters of Captain Scott and of other officers of the Expedition.

The Papers read were:—

"The Voyage of the Antarctic Ship *Discovery*." By the President; George Murray, Esq., F.R.S.; and Hugh Robert Mill, Esq., D.SC., LL.D.

Eighth Ordinary Meeting, March 10, 1902.—Sir CLEMENTS MARKHAM, K.C.B., F.R.S., President, in the Chair.

ELECTIONS.—*Frederick Alcock; Chas. Foreman Allison; Captain John Gerald Berne, R.A.M.C.; Captain Henry Barry Coddington, 37th Hampshire Regt.; William David Forbes; Edwin Ralphs; Edward Hugh Bowring Skimming; William J. Harding King; Walter Thomas Owen; Captain John Arthur Coghill Somerville, Northumberland Fusiliers; Sir Simeon Stuart, Bart.; Joseph Walton, M.P.; Captain G. F. A. Whitlock, R.E.*

The Paper read was:—

"The Geographical Conditions determining History and Religion in Asia Minor." By Prof. W. M. Ramsay.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By EDWARD HEAWOOD, M.A., *Librarian*, R.G.S.

THE following abbreviations of nouns and the adjectives derived from them are employed to indicate the source of articles from other publications. Geographical names are in each case written in full:—

A. = Academy, Academie, Akademie.
Abh. = Abhandlungen.
Ann. = Annals, Annales, Annalen.
B. = Bulletin, Bollettino, Boletim.
Com. = Commerce.
C. Rd. = Comptes Rendus.
Erdk. = Erdkunde.
G. = Geography, Geographie, Geografia.
Ges. = Gesellschaft.
I. = Institute, Institution.
Iz. = Izvestiya.
J. = Journal.
k. u. k. = kaiserlich und königlich.
M. = Mitteilungen.
Mag. = Magazine.
Mem. = Memoirs, Mémoires.
Met. = Meteorological.
P. = Proceedings.
R. = Royal.
Rev. = Review, Revue.
S. = Society, Société, Selskab.
Sitzb. = Sitzungsbericht.
T. = Transactions.
V. = Verein.
Verh. = Verhandlungen.
W. = Wissenschaft, and compounds.
Z. = Zeitschrift.
Zap. = Zapiski.

On account of the ambiguity of the words *octavo*, *quarto*, etc., the size of books in the list below is denoted by the length and breadth of the cover in inches to the nearest half-inch. The size of the *Journal* is 10 × 6½.

A selection of the works in this list will be noticed elsewhere in the "Journal."

EUROPE.

Germany—Elbe. *Z.K. Sächs. Statist. Bureaus* 47 (1901): 1–29. **Ganzenmüller** Statistik des sächsischen Elbverkehrs in den Jahren 1880 bis 1899. Von Dr. Konrad Ganzenmüller.

Germany—Elbe. *M.V. Erdk. Halle-a.-S.* (1901): 46–47. **Maenss.**

Bewegung des Elbwasserstandes bei Magdeburg 1891–1900. Von Prof. J. Maenss. *With Diagrams.*

Germany—Meteorology. *Ann. Hydrographie* **29** (1901): 573–583. **Grossmann.**

Die Aenderung der Temperatur von Tag zu Tag an der deutschen Küste in den Jahren 1890 bis 1899. Dr. Grossmann.

Germany—Oder. **Winkelmann.**

Bericht Ges. Völker- u. Erdk. Stettin (1899–1900): 35–36.

Die Bildung des linken Oderufers von Stettin bis Pölitz. Von Prof. Dr. Winkelmann.

Germany—Riesengebirge. *G.Z.* **7** (1901): 583–590. **Friederichsen.**

Die Riesengebirgs-Exkursion des XIII. Deutschen Geographentages (31. Mai bis 2. Juni 1901). Von Dr. Max Friederichsen. *With Illustrations.*

Germany—Saxony.

Kalender und Statistisches Jahrbuch für das Königreich Sachsen . . . auf das Jahr 1902. Dresden, 1901. Size 9½ × 6½, pp. 320.

Germany—Stettin. *Bericht Ges. Völker- u. Erdk. Stettin* (1899–1900): 5–12. **Keilhack.**

Zur Geologie und Morphologie der Umgebung Stettins. Von Dr. Keilhack. *With Maps.*

Germany—Yew. *M.V. Erdk. Halle a. S.* (1901): 66–69. **Gerbing.**

Die Eiben des Ringgaues und des Eichsfeldes. Von Luise Gerbing.

Greece—Paxos and Antipaxos. *B.S.G. Italiana* **2** (1901): 769–792, 859–882. **Martelli.**

Paxos e Antipaxos nel mare Jonio. Studio geo-fisico del dottor Alessandro Martelli. *With Map and Illustrations.*

Hungary. *Ann. G.* **10** (1901): 438–444. **Lacger.**

La plaine hongroise: Alföld et Puszta. Par M. l'abbé L. de Lacger.

Hungary—Salt-lakes. **Kalecsinsky.**

Ueber die Ungarischen warmen und heissen Kochsalzseen als natürliche Wärmeaccumulatoren, sowie über die Herstellung von warmen Salzseen und Wärmeaccumulatoren. Von Alexander v. Kalecsinsky. Budapest, 1901. Size 10 × 7, pp. 26. *Presented by the Author.*

Iceland—Moraines. **Pjetursson.**

Oversigt K. Danske Vidensk. S. Forhand. (1901): 147–170.

Morænер i den islandske Palagonitformation. Af Helgi Pjetursson. *With Map.*

Italy. *Le Globe, Mém. S.G. Genève* **40** (1901): 85–109. **Chaix.**

Notice sur les Vallées Vaudoises du Piémont. Par Paul Chaix. *With Map.*

Italy—Lakes. *Riv. G. Italiana* **8** (1901): 641–648. **Marinelli.**

Lo studio delle sesse nei laghi italiani. Per Olinto Marinelli.

Observations on the "seiches" in various Italian lakes have lately been made.

Italy—Lemene. *Riv. G. Italiana* **8** (1901): 637–640. **Bertolini.**

Di una piena del fiume Lemene in relazione alla funzione moderatrice dell' Estuario. Nota del prof. G. Lodovico Bertolini.

Italy—Po Delta. **Marinelli.**

L'Accroissement du Delta du Po au XIX^{ème} Siècle. Par S. Marinelli. (Université Nouvelle, Institut Géographique de Bruxelles. Publication No. 6.) Bruxelles: Ferdinand Larcier, 1901. Size 10 × 6½, pp. 36. *Map. Presented by the Institut Géographique de Bruxelles.*

Lake of Constance. *M.G. Ges. Wien* **44** (1901): 262–269. **Fuchs.**

Die Verbreitung der Thierwelt im Bodensee. Von Theodor Fuchs.

Monte Rosa. *Atti R.A. Lincei, Rendiconti* **11** (1902): 24–29. **Dainelli.**

Stato attuale dei ghiacciai del Monte Rosa. Nota di G. Dainelli.

Portugal and Flanders. *B.S.G. Lisboa* **18** (1900): 15–27. **Cantineau.**

Origine des relations commerciales entre la Flandre et le Portugal. Por E. Cantineau.

Russia—Baltic Provinces. *Deutsche Rundschau G.* **24** (1901): 70–77. **Stenin.**

Die Talabskischen Inseln auf dem Pleskauer See. Von P. von Stenin. *With Illustration.*

The Pleskauer See or lake of Pskov is the southern portion of Lake Peipus.

Slav Race. *Bericht Ges. Völker- u. Erdk. Stettin* (1899–1900): 22–25. **Buschan.**

Verbreitung, Eintheilung und Ursprung der slavischen Völkerstämme. Von Dr. Buschan.

Sweden—Plant-life. **Cleve.**

Bihang K. Svensk. Vetens.-A. Handlingar **26** (1901): No. 15, pp. 105.

Zum Pflanzenleben in nordschwedischen Hochgebirgen. Einige ökologische und phänologische Beiträge. Von Astrid Cleve. *With Plates.*

Switzerland. ——

Annuaire Statistique de la Suisse. Publié par le Bureau de Statistique du Département Fédéral de l'Intérieur. Dixième Année, 1901. Bern, 1901. Size 10 × 6½, pp. 368.

Switzerland. **Felber.**

Die Allmenden des alten Landes Schwyz. Von Theod. Felber. (Festschrift der Geographisch-Ethnographischen Gesellschaft in Zürich, pp. 61–84.) Zurich: F. Lohbauer, 1901. Size 9 × 6½. *Map.*

On the historical and economic development of the land corporations of Schwyz.

Switzerland—Fauna. **Stoll.**

Über xerothermische Relikten in der Schweizer Fauna der Wirbellosen. Von Prof. Dr. Otto Stoll. (Festschrift der Geographisch-Ethnographischen Gesellschaft in Zurich, pp. 145–208.) Zurich: F. Lohbauer, 1901. Size 9 × 6½.

Switzerland—Glaciers. *B.S.G. Italiana* **2** (1901): 916–929. **Marson.**

Sui ghiacciai del Bernina, conclusioni e nota suppletiva sui dati idrografici del Mallero. Del Prof. Luigi Marson.

Switzerland—Loess. *Verh. Naturforsch. Ges. Basel* **13** (1901): 271–286. **Gutzwiller.**

Zur Altersfrage des Löss. Von A. Gutzwiller.

Turkey—Crete. *Ann. G.* **10** (1901): 445–446. ——

Mission de MMrs Ardaillon et Cayeux dans l'île de Crète. Par V. L.

This expedition, undertaken early in 1901, had in view geological and geographical research (see *ante*, p. 212).

Turkey—Mitylene. *B.S.G. Com. Bordeaux* **27** (1901): 353–359. **Girard.**

L'île de Mételin. Par B. Girard.

United Kingdom. **Mackinder.**

Britain and the British Seas. By H. J. Mackinder. London: W. Heinemann, 1902. Size 9½ × 6, pp. xvi. and 378. *Maps and Illustrations. Presented by the Publisher.*

This is the subject of a review (*ante*, p. 489).

United Kingdom—Hertfordshire. **Fordham.**

Hertfordshire Maps: a Descriptive Catalogue of the Maps of the County, 1579–1900. By Herbert George Fordham. First Part. (From the *Transactions* of the Hertfordshire Natural History Society, vol. xi. part i.) Size 10 × 7½, pp. 32. *Maps. Presented by the Author.*

United Kingdom—Ireland. *P.R. Irish A.* **6** (1901): 331–389. **Knowles.**

The Fourth Report on the Prehistoric Remains from the Sandhills of the Coast of Ireland. By W. J. Knowles. *With Illustrations.*

United Kingdom—Ireland. *P.R. Dublin S.* **9** (1901): 422–435. **Lyburn.**

Prospecting for Gold in co. Wicklow, and an Examination of Irish Rocks for Gold and Silver. By E. St. John Lyburn. *With Maps.*

United Kingdom—Ireland. *P.R. Irish A.* **6** (1901): 415–449. **Westropp.**

The Cahers of County Clare: their Names, Features, and Bibliography. By Thomas J. Westropp. *With Illustrations.*

A table shows the distribution of the forts—some 2400 in all—by parishes, the individual names with descriptions being given later.

ASIA.

China. **Navarra.**

China und die Chinesen. Auf Grund eines 20 jährigen Aufenthaltes im Lande der Mitte geschildert von B. Navarra. Zweiter Band. Bremen: Max Nössler, 1901. Size 9 × 6, pp. 497–1112. *Map and Illustrations. Price* 9*s.*

This is not a mere record of travel, but contains a large amount of solid information, based on a long residence in the country. The author was, until 1899, editor of the *Ostasiatischen Lloyd* of Shanghai.

China. *B.R.S.G. Madrid* **43** (1901): 166–272. **Olmet.**

El problema de la China. Ensayo por D. Fernando de Antón del Olmet.

China—Manchuria. *Deutsche G. Blätter* **24** (1901): 73–79. **Stavenhagen.**

Der Wert der Mandschurei für Russland. Von W. Stavenhagen.

French Indo-China. *B.S.G. Com. Paris* **22** (1901): 335–350. **Bel.**

En Indo-Chine, du Sous-Sol. Par M. J. Marc Bel.

Deals with the mining resources of French Indo-China.

French Indo-China. **Gervais-Courtellemont, Vandelet, and others.**

Empire Colonial de la France, L'Indo-Chine, Cochinchine, Cambodge, Laos, Annam, Tonkin. Préface par Marcel Dubois. Texte par Gervais-Courtellemont, Vandelet, etc. Paris: Firmin-Didot et Cie. and A. Challamel (not dated). Size 13 × 9½, pp. xvi. and 196. *Map and Illustrations.*

This is the second part of a well-illustrated popular description of the French Colonies, the first part of which dealt with Madagascar (*Journal*, vol. xvii. p. 676).

French Indo-China—Annam. *B.S.G. Com. Paris* **22** (1901): 383–384. **Barthélemy.**

Le régime économique de la Côte d'Annam. Par Cte. P. de Barthélemy.

French Indo-China—Laos. **Reinach.**

L. de Reinach. Le Laos. 2 vols. Paris: A. Charles (not dated). Size 11 × 9, pp. (vol. i.) 534; (vol. ii.) 174. *Maps and Illustrations. Price* 32*s.*

This work does for the northern interior of French Indo-China the service rendered for the more southern regions by M. Aymonier. Besides giving a general view of the physical geography and peoples of the country, the author (a former Government official in the Laos province) supplies a sketch of its political history, and full details as to its resources, trade, industries, means of communication, etc. The second volume consists entirely of appendices supplying notes on special points of interest.

India—Burma. **Nisbet.**

Burma under British Rule—and Before. By John Nisbet. 2 vols. Westminster: A. Constable & Co., 1901. Size 9 × 5½, pp. (vol. i.) x. and 460; (vol. ii.) viii. and 452. *Price* 32*s. Maps and Illustrations.*

This is naturally rather historical than geographical, but a section deals with the economic aspects of Burma.

India—Census. ——

Census of India, 1901. First Total. Showing variation in population since 1881, and percentage of variation. (Extract from the Proceedings of the Government of India in the Home Department (Census), under date Calcutta, the 15th March, 1901.) Size 13½ × 8½. *Presented by Mr. H. H. Risley, Census Commissioner.*

India—Madras. ——

Report on the Kodaikanal and Madras Observations for 1900–1901. Size 13½ × 8½, pp. 18.

India, &c. **Blanford.**

The Distribution of Vertebrate Animals in India, Ceylon, and Burma. By W. T. Blanford, F.R.S. (*Philosoph. Trans. Royal Soc.*, London, Series B., vol. 194, pp. 335–436.) Size 12 × 9. *Map. Presented by the Author.*

The whole of India, Burma, and Ceylon is divided for the purposes of this study into nineteen tracts, distinguished by physical characters, the main zoological features of each being afterwards considered. Apart from tracts forming parts of sub-regions extending beyond the limits of India, the whole is subdivided into two sub-regions, a western or Cis-Gangetic, and an eastern and northern (Trans-Gangetic), the latter extending also into Siam, S. China, etc.

Indian Ocean—Seychelles. *Ann. Idrografici* **2** (1901): 113–129. ——

Cenni sulle Isole Séychelles. Dati raccolti con la R. Nave Staffetta, comandante P. Botti, durante il suo soggiorno a Port-Victoria (1899).

Indo-China. **Leclercq.**

Voyage d'une Française dans l'Indo-Chine. Par Jules Leclercq. (Extrait de *La Revue Générale*, novembre, 1901.) Bruxelles: Oscar Schepens & Cie., 1901. Size 10 × 6½, pp. 12. *Presented by the Author.*

The traveller alluded to is Mme. Isabelle Massieu.

Japan—Formosa. **Wawn.**

Trade of North Formosa for the year 1900. Foreign Office, Annual No. 2728. 1901. Size 9½ × 6, pp. 16. *Price* 1*d.*

Malay Archipelago. **Pflüger.**

Smaragdinseln der Südsee. Reiseeindrücke und Plaudereien. Von Dr. Alexander Pflüger. Bonn: Emil Strauss (not dated). Size 10 × 6½, pp. x. and 244. *Maps and Illustrations. Price* 10*s.*

This profusely illustrated work gives the observations of a young German University lecturer during a voyage through the Malay Archipelago, during which visits were paid to various parts of Sumatra, Celebes, the Moluccas, Dutch and German New Guinea, and the Bismarck Archipelago.

Malay Archipelago—Amboina. **Verbeek.**

Verh. K.A. Wetens. Amsterdam (2) 7 (1900): No. 5, pp. 9.

Over de Geologie van Ambon (ii.). Door R. D. M. Verbeek.

Malay Archipelago—Borneo. **Beccari.**

Odoardo Beccari. Nelle Foreste di Borneo. Viaggi e ricerche di un Naturalista. Firenze: Salvadore Landi, 1902. Size 10 × 7, pp. xvi. and 668. *Maps and Illustrations. Presented by the Author.*

The greater part of this work describes the researches in Borneo, in 1865–68, of the well-known naturalist, Dr. Beccari, since known as a pioneer explorer in New Guinea. In spite of the time that has elapsed since the traveller first made acquaintance with the forests of Sarawak, the work is welcome by reason of the comparative scantiness of the literature on that part of the island. Dr. Beccari gives copious descriptions of the natural features as well as of the native races of the districts visited, and supplies a sketch of the recent development of Sarawak, partly from his own observations during a brief subsequent visit, partly from already published authorities.

Malay Archipelago—Celebes. **Sarasin.**

Entwurf einer Geographisch-Geologischen Beschreibung der Insel Celebes. Von Dr. Paul Sarasin und Dr. Fritz Sarasin. Weisbaden: C. W. Kreidel, 1901. Size 13 × 10, pp. xi., 344, and 28. *Maps and Plates. Price* 50*s.*

This important work will be specially noticed.

Malay Archipelago—Key Islands. **Langen.**

Die Kei oder Kii-Inseln des O. I. Archipelago, aus dem Tagebuche eines Colonisten. Von Kapt. H. Gottfr. Langen. Wien: Carl Gerold's Sohn, 1902 [1901]. Size 9½ × 6, pp. 69. *Map and Illustrations. Presented by the Author.*

Malay Archipelago—Sumatra. **Schlegel.**

Geographical Notes, XVI. The Old States in the Island of Sumatra. By G. Schlegel. (Reprinted from the T'oung-Pao, series ii. vol. ii.) Leyden: Oriental Printing Office, formerly E. J. Brill, 1901. Size 10 × 6½, pp. 98. *Presented by the Author.*

This will be noticed in the Monthly Record.

Persia. *J.S. Arts* **50** (1901): 65-78. **Penton.**

The New Trade Route to Persia by Nushki and Sistán. By Edward Penton, B.A. *With Map.*

Persian Gulf—Trade. **Kemball.**

Trade of Persian Gulf for the year 1900. Foreign Office, Annual No. 2631, 1901. Size 9½ × 6, pp. 50. *Price* 3*d.*

Russia. **Meister.**

Russland in Asien. Historisch-wirtschaftliche Skizze. Von M. Meister. (Festschrift der Geographisch-Ethnographischen Gesellschaft in Zürich, pp. 85–125.) Zurich: F. Lohbauer, 1901. Size 9 × 6½. *Map.*

The map shows the Siberian railway and other projected lines.

AFRICA.

Angola. *Miss. Catholiques* **33** (1901): 569–572, 581–584, 597–599, 610–612. **Lecomte.**
A travers la Haute-Cimbébasie. Rapport du R. P. E. Lecomte. *Map and Illustr.*

Angola. *Scottish G. Mag.* **17** (1901): 575–582. **Lewis.**
Itineraries in Portuguese Congo. By Rev. Thomas Lewis.
A paper read at the Glasgow meeting of the British Association.

Angola. **Negreiros.**
Colonies Portugaises: Angola. Brève Notice. Par A. d'Almada Negreiros. Paris: Alcan-Levy, 1901. Size 9½ × 6, pp. 48. *Map and Illustrations. Presented by the Author.*

British Central Africa. *P. Philosoph. S. Glasgow* **82** (1900–1901): 60–75. **Fraser.**
The Zulu of Nyasaland: their Manners and Customs. By the Rev. Donald Fraser.

British Central Africa. **Sharpe.**
Trade and General Condition of British Central Africa Protectorate for the Year 1900–1901. Foreign Office, Annual No. 2722, 1901. Size 9½ × 6, pp. 46. *Price* 2½*d.*

British Central Africa—Cacao Cultivation. **McClounie.**
Theobroma Cacao. Nos. 2 & 3, Scientific Series Local Circulars, Jan. and April, 1901.

British Central Africa—Livingstonia Mission. ———
The Livingstonia Mission of the United Free Church of Scotland (British Central Africa) Report for 1900. Size 8½ × 5½, pp. iv. and 80. *Map and Illustrations. Presented by United Free Church of Scotland.*

British East Africa. **Eliot.**
Africa. No. 9 (1901). Report by His Majesty's Commissioner on the East Africa Protectorate. London: Eyre and Spottiswoode, 1901. Size 13½ × 8½, pp. 26. *Price* 3*d.*

British East Africa. **Gregory.**
The Foundation of British East Africa. By J. W. Gregory. London: H. Marshall & Son, 1901. Size 8½ × 5½, pp. xii. and 268. *Map and Illustrations. Presented by the Publishers.*

This work is intended as a popular account of the course of events which have led to the acquisition for Great Britain of her extensive East African territory, and of the progress so far made with its development. It should prove of much use in enabling the general reader to gain an adequate idea of the history of British East Africa without being obliged to consult the numerous works in which the information is otherwise scattered. Dr. Gregory writes, as a rule, with full knowledge of his subject, and gives an instructive sketch of the dawn of East African geography, as well as of the modern explorations by which that geography has become more accurately known. One or two points, however, might be criticized. Thus, while referring to the information on Arab routes published by Denhardt in 1881, he makes no allusion to the similar information collected by Mr. Wakefield, and published eleven years earlier in the R.G.S. *Journal*. Again he is inclined to build too much as regards early Portuguese travels on Sanson d'Abbeville's map of 1635, since the development of that map at the hands of cartographers from 1522 onwards can be clearly traced.

Cape Colony. ———
Statistical Register of the Colony of the Cape of Good Hope for the year 1900, with Supplement partly for March Quarter, 1901, and partly for half-year ended June 30th, 1901. Cape Town: W. A. Richards & Sons, 1901. Size 13 × 8, pp. xvi. and 348. *Diagram. Presented by the Under Colonial Secretary.*

Central Africa—Kivu. *Petermanns M.* **47** (1901): 259–260. **Herrmann.**
Die Kivu-Vulkane. Briefliche Mitteilung des K. Grenzkommissars Hauptmann Herrmann.

Congo State. **Lemaire.**
Mission Scientifique du Ka-Tanga. Résultats des observations astronomiques, magnétiques et altimétriques effectuées sur le territoire de l'État Indépendant du Congo, du 4 août 1898 au 2 septembre 1900. Premier mémoire (pp. 68, *Illustrations*); Deuxième mémoire, du 4 août 1898 au 24 novembre 1898 (pp. 88); Troisième mémoire, du Mardi 10 janvier 1899 au Samedi 25 mars 1899 (pp. 70); Quatrième mémoire, du Dimanche 7 mai 1899 au Lundi 12 juin 1899 (pp. 66); Cinquième mémoire, du Mardi 13 juin 1899 au Mercredi 19 juillet 1899 (pp.

46); Sixième mémoire, du Dimanche 23 juillet 1899 au Jeudi 17 août 1899 (pp. 60); Septième mémoire, du Vendredi 18 août 1899 au Vendredi 15 septembre 1899 (pp. 58); Huitième mémoire, du Lundi 18 septembre 1899 au Samedi 14 octobre 1899 (pp. 60); Neuvième mémoire, du Samedi 21 octobre 1899 au Lundi 13 novembre 1899 (pp. 46); Dixième mémoire, du Vendredi 17 novembre 1899 au Mercredi 24 janvier 1900 (pp. 70); Onzième mémoire, du 27 janvier 1900 au 23 mars 1900 (pp. 66); Douzième mémoire, du Samedi 24 mars 1900 au vendredi 20 avril 1900 (pp. 50); Treizième mémoire, du Samedi 21 avril 1900 au Lundi 14 mai 1900 (pp. 64); Quatorzième mémoire, du Mardi 15 mai 1900 au dimanche 10 Juin 1900 (pp. 78); Quinzième mémoire, du Vendredi 15 juin au Samedi 25 août 1900 (pp. 94). Par le Capitaine Charles Lemaire. Size 13 × 10. *Presented by the Author.*

The value of Captain Lemaire's astronomical and other observations has been frequently dwelt upon in the *Journal*. The publication of the full results supplies a solid basis for the cartography of the southern portion of the Congo State.

Congo State. *B.S.G. Com. Paris* **22** (1901): 257–283. **Lemaire.**

La mission scientifique belge du Ka-Tanga. Par le Capitaine Ch. Lemaire. *With Map.*

Congo State. *Scottish G. Mag.* **17** (1901): 526–556. **Lemaire.**

On the Congo: the Belgian Scientific Expedition to Ka-Tanga. By Captain Lemaire. *With Portrait and Map.* Captain Lemaire's Itinerary.

Congo State. *Mouvement G.* **18** (1901): 643–651. ——

Compagnie du Congo pour le Commerce and l'Industrie. Assemblée générale ordinaire du Décembre 16, 1901. *With Map.*

The map shows the territories of the chief commercial companies at work in the Congo State.

Congo State. *Mouvement Géographique* **18** (1901): 607–615. ——

La Compagnie du Kasai. *With Map.*

Dahome—Railway. *Rev. Française* **26** (1901): 701–709. **Montell.**

Le chemin de fer du Dahomey. Par A. Montell. *With Map.*

East Africa—Coral-reefs. *Z. Ges. Erdk. Berlin* **36** (1901): 115–144. **Werth.**

Lebende und jungfossile Korallenriffe in Ost-Afrika. Von Dr. Emil Werth. *With Maps and Illustrations.*

East Africa—Nyasa. *Kolon. Z.* **2** (1901): 409–412. ——

Die Schirehochlandbahn und die Afrikanischen Seengebiete.

The writer considers that the fears which have been expressed, that the proposed Shire railway will have a prejudicial effect on German East Africa, are unfounded.

East and South Africa. **Schanz.**

Ost- und Süd-Africa. Von Moritz Schanz. Berlin: Wilhelm Süsserott, 1902. Size 13 × 7, pp. 458. *Illustrations. Price* 10*s.*

The writer gives a useful account of the present condition of the various European possessions in East and South Africa from his observations during a recent journey.

Egypt—Archæology. **Brodrick and Morton.**

A Concise Dictionary of Egyptian Archæology. A Handbook for Students and Travellers. By M. Brodrick and A. Anderson Morton. London: Methuen & Co., 1902. Size 7 × 5, pp. viii. and 198. *Illustrations. Price* 3*s.* 6*d. Presented by the Publishers.*

Intended as a handy book of reference for students and travellers in Egypt, containing much information on the archæology of the country in a condensed form.

Egypt—Bedawin. **Chantre.**

Les Bédouins d'Égypte. Esquisse Ethnographique et Anthopométrique. Par Ernest Chantre. Lyon: A. Rey & Cie., 1901. Size 9 × 5½, pp. 40.

Egypt—Kharga Oasis. **Ball.**

Kharga Oasis: its Topography and Geology. By John Ball, PH.D. (Survey Department, Public Works Ministry. Geological Survey Report, 1899, part ii.) Cairo, 1900. Size 11 × 7½, pp. 116. *Maps, Plans, and Illustrations.*

One of the valuable series of memoirs, of which those relating to Farafra and Dakhla have already been noticed in the *Journal*.

Egyptian Sudan. *B.S.G. Italiana* **2** (1901): 930–940. **Tappi.**
Un' escursione sul basso Sobat, lettera del padre L. Tappi al socio tenente di vascello L. Vannutelli.

Eritrea. *Riv. G. Italiana* **8** (1901): 649–653. **Mori.**
La carta dimostrativa della Colonia Eritrea e regioni adiacenti e le critiche del Prof. Guido Cora. Attilio Mori.

French Congo. *B.S.G. Com. Paris* **22** (1901): 393–400. **Rouhaud.**
La moyenne Nyanga (Congo français). Par M. Rouhaud.

French Congo. *B. Comité l'Afrique Française* **11** (1901): 295–301. ———
Dans le Haut-Oubangui. Par M. A. T. *With Map and Portraits.*
Account of recent French explorations, including those of MM. Superville and Bos referred to in the *Journal* for January (p. 89).

French Sahara—In-Salah. *C. Rd.* **134** (1902): 25–28. **Flamand.**
Sur la position géographique d'In-Salah, oasis de l'archipel Touatien (Tidikelt). Sahara central. Note de M. G. B. M. Flamand.
See note, *ante*, p. 375.

French West Africa. *B.S.G. Com. Paris* **22** (1901): 303–319. **Joalland.**
Autour du Tchad. Par M. le Capitaine Joalland. *With Map.*

French West Africa—Senegal. **Erskine.**
Trade of Senegal for the year 1900. Foreign Office, Annual No. 2725, 1901. Size 9½ × 6, pp. 10. *Price* 1*d.*

French West Africa—Senegal. *C. Rd.* **134** (1902): 60–63. **Vasseur.**
Sur la découverte du terrain nummulitique dans un sondage exécuté à Saint-Louis du Sénégal. Note de M. G. Vasseur.

German East Africa. *M. Deutsch. Schutzgeb.* **14** (1901): 225–228. **Ambronn.**
Resultate der von Herrn Hauptmann Schlobach im Jahre 1898 ausgefuhrten astronomischen Ortsbestimmungen. Berechnet von Prof. Dr. Ambronn.

German East Africa. *Deutsch. Kolonialblatt* **12** (1901): 902–906. **Charisius.**
Reisebericht des Hauptmanns Charisius.
On an expedition through the steppe-regions in the northern interior of German East Africa.

German East Africa. *Z. Ges. Erdk. Berlin* **36** (1901): 152–164. **Kohlschütter.**
Die Grabenländer im Nördlichen Deutsch-Ost-Afrika. Von Dr. E. Kohlschütter.
On the results of the "Pendulum Expedition."

German Possessions—Boundaries. *Globus* **80** (1901): 387–388. **Singer.**
Der Stand der Abgrenzung unserer afrikanischen Schutzgebiete. Von H. Singer.

NORTH AMERICA.

Canada. *P. and T.R.S. Canada* **6** (1901): 99–120. **Ells.**
The Physical Features and Geology of the Palæozoic Basin between the Lower Ottawa and St. Lawrence Rivers. By R. W. Ells.

Canada. *P. and T.R.S. Canada* **6** (1900): 175–177. **Laflamme.**
Modifications remarquables causées à l'Embouchure de la Rivière Ste. Anne par l'Eboulement de St. Alban. Par J. C. K. Laflamme.

Canada. *P. and T.R.S. Canada* **6** (1900): 179–186. **Laflamme.**
Eboulement à Saint Luc-de-Vincennes, Rivière Champlain, le 21 septembre 1895. Par J. C. K. Laflamme. *With Illustrations.*

Canada—British Columbia. ———
The Year Book of British Columbia. Compendium, 1897–1901. Victoria, B.C. Size 10 × 7, pp. 216. *Map and Illustrations.*

Canada—British Columbia. *Alpine J.* **20** (1901): 491–504. **Stutfield.**
Mountain Travel and Climbs in British Columbia. By Hugh E. M. Stutfield. *With Illustrations.*
Describes the journey made in 1900 in company with Prof. N. Collie (*Journal*, vol. xvii. p. 252).

Canada—Geology. *P. and T.R.S. Canada* **6** (1900): 187–225. **Ami.**

Synopsis of the Geology of Canada. (Being a summary of the principal terms used in Canadian Geological Nomenclature.) By Henry M. Ami.

Canada—Labrador. *Blackwood's Mag.* **170** (1901): 688–698. **Grenfell.**

Life in Labrador. By W. T. Grenfell.

Canada—Ornithology. **Macoun.**

Geological Survey of Canada. Catalogue of Canadian Birds. Part i. Water Birds, Gallinaceous Birds, and Pigeons. Including the following orders: Pygopodes, Longipennes, Tubinares, Steganopodes, Anseres, Herodiones, Paludicolæ. Limicolæ, Gallinæ, and Columbæ. By John Macoun. Ottawa, 1900. Size 10 × 6½, pp. viii. and 218. *Presented by the Geological Survey of Canada.*

Canada—Rocky Mountains. *Travel* **6** (1901): 243–248. **Steele.**

In the Heart of the Canadian Rockies. By Louis J. Steele. *With Illustrations.*

On a journey in the Mount Assiniboine region in 1901, in which Mr. H. G. Bryant took part.

Mexico. *P. and T.R.S. Canada* **6** (1900): 205–265. **Campbell.**

Mexican Colonies from the Canary Islands traced by Language. By the Rev John Campbell. *With Plates.*

Mexico. *B.S.G. y Estadistica Rep. Mexicana* **4** (1897): 264–269. **Noriega.**

Los progresos de la Geografia en Mexico. Por el señor Profesor Eduardo Noriega.

Mexico—Popocatepetl. *M.G. Ges. Wien* **44** (1901): 219–238. **Schmit.**

Eine Besteigung des Popocatepetl in Mexico im Jahre 1866. Von Dr. Ernst Ritter Schmit v. Tavera.

North America—Mammals. **Elliot.**

A List of the Land and Sea Mammals of North America north of Mexico. Supplement to the Synopsis. By D. G. Elliot. (Field Columbian Museum, Publication 57. Zoological Series, vol. ii. No. 2.) Chicago, 1901. Size 10 × 6½, pp. 477–522. *Plates.*

United States. *National G. Mag.* **12** (1901): 381–389. ———

The Sex, Nativity, and Colour of the People of the United States. *With Diagrams.*

United States.—California. *National G. Mag.* **12** (1901): 391–392. **Holder.**

A remarkable Salt Deposit. By Charles F. Holder. *With Illustrations.*

On the method of exploitation at Salton, California.

United States—Oregon. *J. School G.* **5** (1901): 281–289. **Russell.**

Climate, Vegetation, and Drainage of Cascade Mountains of Northern Washington. By I. C. Russell.

Abstracted from a paper by Prof. Russell, noticed in vol. xvii. of the *Journal* (p. 662).

United States—Texas. *National G. Mag.* **12** (1901): 430–432. **Baker.**

The Lost Boundary of Texas. By Marcus Baker. *With Map.*

Many of the monuments set up by Clark during his survey of the 103rd meridian in 1859–60 have disappeared, and a fresh survey is much needed.

United States—Urban Population. ———

Twelfth Census of the United States. Urban Population in 1900. (Census Bulletin, No. 70, July 11, 1901.) Size 11½ × 9, pp. 14.

This was noticed in the *Journal* for October, 1901 (p. 445).

United States—Utah. *Scottish G. Mag.* **17** (1901): 617–644. **Talmage.**

The Great Salt Lake. By Prof. James E. Talmage, PH.D. *Map and Illustrations.*

CENTRAL AND SOUTH AMERICA.

Bolivia and Paraguay. **Quijarro**

La Cuestión de límites entre Bolivia y el Paraguay. Documentos de la Mision confidencial desempeñada por el Doctor Antonio Quijarro en Enero de 1901. Buenos Aires, 1901. Size 8½ × 6, pp. 114. *Presented by the Author.*

British West Indies. **Walker.**

The West Indies and the Empire. Study and Travel in the Winter of 1900–1901. By H. de R. Walker. London: T. Fisher Unwin, 1901. Size 9 × 5½, pp. x. and 254. *Map. Presented by the Publisher.*

A study of the West Indian problem, based on personal investigation. While dealing largely with the position of the sugar industry, the author keeps in view the wider question of Imperial responsibility for the welfare of our West Indian colonies, and attempts to answer the question whether we have done all that is required to further that welfare.

Central America and West Indies. **Keane.**

Stanford's Compendium of Geography and Travel (New Issue), Central and South America. Vol. II. Central America and West Indies. By A. H. Keane. Edited by Sir Clements Markham, K.C.B., F.R.S. London: Edward Stanford, 1901. Size 8 × 5½, pp. xxiv. and 496. *Maps and Illustrations. Price* 15*s. Presented by the Publisher.*

This will be specially noticed.

Chile. *Petermanns M.* **47** (1901): 262-264. **Hammer.**

Die Messungsmethoden der chilenischen Grenzkommission. Von Prof. Dr. E. Hammer.

The writer discusses the methods of survey described in Prof. Bertrand's paper in the *Journal* for September, 1900.

Costa Rica. *B.I. Fis.-G. Costa Rica* **1** (1901): 219-222. **Pittier.**

La presión atmosférica en San José según las observaciones practicadas de 1889 á 1900 en el observatorio Meteorológico Nacional por Enrique Pittier. *With Diagram.*

Jamaica. ———

Institute of Jamaica. Jamaica in 1901: a Handbook of Information for Intending Settlers, with Notes for Visitors. Kingston, Jamaica. London: H. Sotheran & Co., 1901. Size 9 × 5½, pp. vi. and 112. *Map and Illustrations. Presented by Messrs. H. Sotheran & Co.*

Patagonia and Chile. **Stephani.**

Bihang K. Svensk. Vetens.-A. Handlingar **27** (1901): No. 6, pp. 69.

Beiträge zur Lebermoos-Flora Westpatagoniens und des südlichen Chile. Von F. Stephani. Mit einer Einleitung von P. Dusén.

South America—Palms. **Lindman.**

Bihang K. Svensk. Vetens.-A. Handlingar **26** (1901): No. 5, pp. 42.

Beiträge zur Palmen-Flora Südamerikas. Von C. A. M. Lindman. *With Plates.*

AUSTRALASIA AND PACIFIC ISLANDS.

Australia—Discovery. *R.G.S. Australasia (Victoria)* **19** (1901): 63-82. **Gordon.**

Did De Quiros land at Port Curtis? A Reply to Cardinal Moran. By George Gordon.

Australia—Discovery. *R.G.S. Australasia (Victoria)* **19** (1901): 39-52. **Moran.**

Was Australia discovered by De Quiros in the year 1606? Additional remarks by His Eminence Cardinal Moran. Also separate copy. Sydney and Brisbane: W. Brooks & Co., 1901.

This was referred to in the Monthly Record for March.

Australia—Discovery. *R.G.S. Australasia (Victoria)* **19** (1901): 53-62. **Sutherland.**

De Quiros and the Discovery of Australia. A Reply to Cardinal Moran. By Alexander Sutherland, M.A.

Australia—Early Voyages. **Thomson.**

R.G.S. Australasia (Victoria) **19** (1901): 85-88.

H.M.S. *Lady Nelson.* By Captain Wm. Campbell Thomson. *With Illustration.*

It was one of the boats of the *Lady Nelson* that first discovered and entered Port Phillip.

Australia—Water Supply. *J.R. Colonial I.* **33** (1901-2): 40-54. **Cox.**

The Water Supply of Australia. By W. Gibbons Cox.

Fiji. **Vaughan.**

Fiji. Meteorological Observations taken at Siwa during 1900. By J. D. W. Vaughan. Siwa: E. J. March, 1901. Size 13 × 8½, pp. 16.

German New Guinea. *M. Deutsch. Schutzgeb.* **14** (1901): 229-241. **Schnee.**

Ueber Ortsnamen im Bismarck-Archipel. Von Bezirksrichter Dr. Schnee. *Map.*

New Guinea. **Niermeyer.**
Tijds. K. Ned. Aard. Genoots. Amsterdam **18** (1901): 956–962.
De Zuidkust van Nieuw-Guinea. Door J. F. Niermeyer.

New Zealand. **Barron.**
Report of the Department of Lands and Survey, New Zealand, for the year 1900–1901. By Alexander Barron, Assistant Surveyor-General. Wellington, 1901. Size 13 × 8½, pp. xxvi. and 396. *Maps, Plans, and Illustrations.*
See note in February *Journal* (p. 221).

New Zealand—Historical. *J. Polynesian S.* **10** (1901): 107–165. **Best.**
Te Whanga-Nui-A-Tara. Wellington in Pre-Pakeha Days. By Elsdon Best.
On Maori traditions and their bearing on the question of the first peopling of New Zealand.

Pacific. *R.G.S. Australasia (Victoria)* **19** (1901): 17–29. **Chewings.**
Amongst Tropical Islands. By Miss Hannah Chewings. *Map and Illustrations.*

Pacific. *National G. Mag.* **12** (1901): 413–429. **Langley.**
Diary of a Voyage from San Francisco to Tahiti and Return, 1901. By S. P. Langley. *With Maps and Illustrations.*

Pitcairn Island. ———
Further Correspondence relating to the Condition of the Pitcairn Islanders. London: Eyre & Spottiswoode, 1901. Size 13 × 8½, pp. 8. *Price* 1*d.*

Queensland. **Dixon.**
Index to Names of Places, Mines, Reefs, etc., occurring in the Geological Survey Reports, Queensland. Nos. 1 to 134 (inclusive). By Russell Dixon. Brisbane, 1901. Size 13½ × 8½, pp. 26.

POLAR REGIONS.

Antarctic—Belgian Expedition. *Ann. G.* **10** (1901): 454–461. **Zimmermann.**
Quelques résultats de l'expedition antarctique belge. Par Maurice Zimmermann.

Antarctic—German Expedition. *Petermanns M.* **47** (1901): 231–233. **Drygalski.**
Die deutsche Südpolar-Expedition, Erster Bericht. Von Professor Dr. E. v. Drygalski.
See note in *Journal* for January (p. 97).

Antarctic—German Expedition. *Verh. Ges. Erdk. Berlin* **28** (1901): 422–428. **[Drygalski.]**
Erster Bericht des Leiters der Deutschen Südpolar-Expedition.

Arctic—Bear Island. **Cleve.**
Bihang K. Svensk. Vetens. A. Handlingar **26** (1901): No. 10, pp. 25.
Beiträge zur Flora der Bären-Insel. I. Die Diatomeen. Von Astrid Cleve.

Arctic—Bear Island. **Swenander.**
Bihang K. Svensk. Vetens. A. Handlingar **26** (1901): No. 3, pp. 50.
Beiträge zur Fauna der Bären-Insel. I. Die Vögel. Von G. Swenander. *With Map and Plates.*
Papers on other sections of the Flora and Fauna appear in the same volume.

Arctic—Crustacea. **Ohlin.**
Bihang K. Svensk. Vetens. A. Handlingar **26** (1901): No. 12, pp. 54.
Arctic Crustacea collected during the Swedish Arctic Expeditions, 1898 and 1899, under the direction of Professor A. G. Nathorst. I. Leptostraca, Isopoda, Cumacea. By Axel Ohlin. *With Plates.*

Arctic—Franz Josef Land. *P.R. Dublin S.* **9** (1900): 271–282. **Carpenter.**
Collembola from Franz-Josef Land. (Collected by Mr. W. S. Bruce, 1896-97.) By George H. Carpenter, B.SC. Pantopoda from the Arctic Seas. (Dredged by Mr. W. S. Bruce, 1897-98.) By George H. Carpenter, B.SC.

Arctic—Jan Mayen. **Dusén.**
Bihang K. Svensk. Vetens. A. Handlingar **26** (1901): No. 13, pp. 16.
Beiträge zur Flora der Insel Jan Mayen. Von P. Dusén. *With Plate.*

Polar Exploration. *Globus* **81** (1902): 21–26. **Singer.**
Die Polarforschung im Jahre 1901. Von H. Singer.

Polar Regions. *P. Philosoph. S. Glasgow* **32** (1900–1901): 1–12. **Bruce.**
Arctic and Antarctic. By William S. Bruce. *With Illustrations.*

Spitsbergen. **Carlheim-Gyllenskold.**
Bihang K. Svensk. Vetens. A. Handlingar **26** (1901): No. 4, pp. 54.
Travaux de l'expédition suédoise au Spitzberg en 1898 pour la mésure d'un arc du méridien. Par V. Carlheim-Gyllenskold. No. 4, Déterminations de latitudes et de longitudes.

Spitsbergen and Bear Island. **Andersson and Hesselman.**
Bihang K. Svensk. Vetens. A. Handlingar **26** (1901): No. 1, pp. 88.
Bidrag till Kännedomen om Spetsbergens och Beeren Eilands Kärlväxtflora, grundade på iakttagelser under 1898 års svenska polarexpedition. Af Gunnar Andersson och Henrik Hesselman. *With Plates.*

MATHEMATICAL GEOGRAPHY.

Precession. *P.R. Irish A.* **6** (1901): 450–456. **Close.**
Hipparchus and the Precession of the Equinoxes. By Rev. Maxwell H. Close.

Surveys. *Z. Ges. Erdk. Berlin* **36** (1901): 145–151. **Stavenhagen**
Über die englische Landesaufnahme in Europe und Vorder-Indien. Von W. Stavenhagen.

Surveys—Levelling. *A.I. Técnico é Industrial Peru*, **No. 5** (1901): 5–37. **Blume.**
Sociedad Nacional de Ingenieros Año 1901. Ajuste de los Instrumentos de nivelar. Por el ingeniero Federico Blume.

PHYSICAL AND BIOLOGICAL GEOGRAPHY.

Geology. *P.R. Dublin S.* **9** (1900): 325–332. **Joly.**
On the Inner Mechanism of Sedimentation. (Preliminary Note.) By J. Joly, D SC.

Geology—Wind-Action. **Credner.**
Bericht Ges. Völker- u. Erdk. Stettin (1899–1900): 30–35.
Ueber die geologischen Wirkungen des Windes. Von Professor Dr. Credner.

Geomorphology—Fiords. *J. School. G.* **5** (1901): 326–333. **Hubbard.**
Fiords. By George D. Hubbard.

Glacial Epoch. *Ciel et Terre* **22** (1901): 27–65. **Arçtowski.**
A propos de la question du climat des temps glaciaires. Par H. Arçtowski.

Glaciers—Moraines. *Abh. K.K.G. Ges. Wien* **3** (1901): (Nr. 4): pp. 334. **Böhm.**
Geschichte der Moränenkunde Von Dr. August Böhm Edlen von Böhmersheim. *With Plates. Also separate copy.*
The larger part of this work consists of a historical *résumé* of research on the subject of moraines. This is followed by an account of the discussion at the glacier conference of 1899, and a statement of the author's views as to the classification and nomenclature of moraines, which differ considerably from those adopted at the conference. A bibliography of 650 books and papers on moraines is added.

Ice-Caves. *Nat. G. Mag.* **12** (1901): 433–434. **McGee.**
Ice-Caves and Frozen Wells. By W J McGee.
After referring to Mr. Kimball's paper on this subject (cf. *ante*, p. 220), the writer points out the need for observation of the allied phenomena of "blowing caves," "breathing wells," etc.

Limnology. *Bericht Ges. Völker- u. Erdk. Stettin* (1899–1900): 15–18. **Halbfass.**
Einige Kapitel aus der modernen Seeenforschung. Von Dr. Halbfass.
On the modern development of limnological research.

Meteorology—Snow. *Meteorolog. Z.* **18** (1901): 567–570. **Westmann.**
Einige Beobachtungen über das Schwinden einer Schneedecke. Von Dr. J. Westmann.

Oceanography. *Deutsche G. Blätter* **24** (1901): 96–174. **Krug.**
Die Kartographie der Meeresströmungen in ihren Beziehungen zur Entwickelung der Meereskunde. Von Martha Krug.

Oceanography. **Thoulet and Studer.**

Résultats des Campagnes scientifiques accomplies sur son yacht par Albert Ier Prince Souverain de Monaco, publiés sous sa direction avec le concours de M. Jules Richard. Fasc. xix., Étude de fonds marins provenant du voisinage des Açores et de la portion orientale de l'Atlantique nord, par J. Thoulet (pp. 66). Fasc. xx., Alcyonaires provenant des Campagnes de l'*Hirondelle* (1886–1888), par Th. Studer. 1901. Size 14 × 11, pp. 64. *Plates. Presented by H.S.H. the Prince of Monaco.*

Oceanography. *Rev. Scientifique* **16** (1901): 737–741. **Thoulet.**

La transparence et la couleur de la mer. Par M. J. Thoulet.

Oceanography—Atlantic Ocean. **Cleve, Ekman, and Pettersson**

Les variations Annuelles de l'eau de surface de l'Océan Atlantique. Par P. T. Cleve, G. Ekman, O. Pettersson. Göteborg: Bonniers Tryckeri Aktiebolag, 1901. Size 18 × 12½. *Charts and Diagrams.*

This is noticed elsewhere (*ante*, p. 358).

Oceanography—Methods. *Rev. Maritime* **151** (1901): 2207–2212. **Thoulet.**

Sur le mode de récolte des échantillons du sol sous-marin. Par J. Thoulet.

River-Capture. *C. Rd.* **133** (1901): 961–963. **Fournier.**

Les phénomènes de capture des cours d'eau superficiels par les cours d'eau souterrains, dans les régions calcaires. Note de M. E. Fournier.

This is noticed in the Monthly Record.

Rivers and Lakes. *B.S.G. Lille* **36** (1901): 385–392. **Quarré-Reybourbon.**

Un Manuscrit géographique du XVIIIe siècle. Par L. Quarré-Reybourbon.

The manuscript, by F. C. de Venasque (1766), forms a hydrographical dictionary of the rivers and lakes of the world.

ANTHROPOGEOGRAPHY AND HISTORICAL GEOGRAPHY.

Agriculture. *Ann. G.* **10** (1901): 385–400. **Hitier.**

L'évolution de l'agriculture. Par Henri Hitier.

Anthropogeography. *Popular Science Monthly* **60** (1901): 158–165. **Clayton.**

The Influence of Rainfall on Commerce and Politics. By H. Helm Clayton.

Anthropology. *Scottish G. Mag.* **17** (1901): 569–574. **Dingelstedt.**

Anthropological Investigations in the Alps and the Caucasus. By Victor Dingelstedt.

Anthropology. **Hutchinson and Others.**

The Living Races of Mankind. A popular illustrated account of the customs, habits, pursuits, feasts, and ceremonies of the Races of Mankind throughout the world. By H. N. Hutchinson, J. W. Gregory, R. Lydekker, assisted by eminent specialists. London: Hutchinson & Co. [Not dated.] Size 11 × 8½, pp. 8, viii., and 584. *Maps and Illustrations. Presented by the Publishers.*

This work will be useful as supplying to the general public a comprehensive account of the various races of mankind, brought together from the writings of the best-known travellers and anthropologists. It is remarkable for the very extensive series of illustrations, all from photographs, which will be of value to students as well as the class of readers for which the work is primarily intended. The work is in the main descriptive, and disputed questions as to the origin and affinities of the races are very briefly touched upon, if alluded to at all. Thus the opening chapter starts at once with a description of the Polynesians, without any general treatment of the broad problems of anthropology, while in describing the races of Europe, the authors give no introductory sketch of the problems of classification, on which recent research has thrown so much light. The book is therefore to be regarded as supplementary to more systematic treatises rather than as complete in itself.

Colonization—Methods.

Treasury Department.—Bureau of Statistics, Colonial Administration, 1800–1900. Methods of Government and Development adopted by the principal Colonizing Nations in their control of Tropical and other Colonies and Dependencies, with Statistical Statements of the Area, Population, Commerce, Revenue, etc., of each of the World's Colonies. Including Bibliography of Colonies and Colonization prepared by the Library of Congress. (From the Summary of Commerce and Finance for October, 1901.) Washington, 1901. Size 11½ × 9½, pp 1199–1631. *Map.*

Commercial Geography. *P. American Philosoph. S.* **40** (1901): 62–85. **Haupt.**
Methods of Improving Ocean Bars. By Lewis M. Haupt.

Commercial Geography—Gold. **Servigny.**
Rev. Française **26** (1901): 407–419, 455–465.
L'or dans le Monde. Par J. Servigny. *With Maps and Illustrations.*

Commercial Geography—Maps. **Friedrich.**
Die Anwendung der Kartographischen Darstellungsmittel auf wirtschaftsgeographischen Karten. Von Ernst Friedrich. Leipzig: J. C. Hinrichs, 1901. Size 10 × 7½, pp. 30. *Map. Presented by the Publisher.*
The author, who is engaged in the preparation of a commercial map of Africa on the scale of 1 : 10,000,000, here discusses the methods to be recommended for such maps.

BIOGRAPHY.

Déchy. *Deutsche Rundschau G.* **24** (1901): 84–88. ——
Moriz v. Déchy. *With Portrait.*

Kingsley. **Hayford.**
Mary H. Kingsley from an African Standpoint. By Rev. Mark C. Hayford. London: Bear & Taylor. [1901.] Size 7 × 5, pp. 16. *Portrait. Price* 2*d. Presented by the Author.*

Negreiros. ——
M. Almada Negreiros, Géographe et Littérateur Portugais. *With Portrait.* (From *Les Actualités Diplomatiques and Coloniales*, Sept.–Octobre, 1901, pp. 206–208.) Size 11 × 7½.

Nordenskiöld. *Deutsche Rundschau G.* **24** (1901): 88–90. ——
Adolf Erik Freiherr v. Nordenskiöld. *With Portrait.*

Orleans. *Rev. Française* **26** (1901): 546–550. ——
Mort du Prince Henri d'Orléans. *With Portrait.*

Torquatus. *M.V. Erdk. Halle a. S.* (1901): 17–45. **Berg.**
Georg Torquatus als ältester Halberstädter Topograph (1574). Von A. Berg.

GENERAL.

Balloon Ascents—Respiration. *C. Rd.* **133** (1901): 949–951. **Tissot and Hallion.**
Les phénomènes physiques et chimiques de la respiration à différentes altitudes, pendant une ascension en ballon. Note de MM. J. Tissot et Hallion.

Ballooning. *Rev. Française* **27** (1902): 1–24. **De la Vaulx.**
L'aéronautique maritime: la traversée du "Mediterranean." Par C^te^ Henry de la Vaulx. *With Map and Illustration.*

British Empire. ——
The Harmony of the Empire; being a Series of Sketches in Pictorial Geography of the British Possessions and Spheres of Influence. For Schools and General Reading. Manchester: A. Heywood & Son, 1901. Size 7½ × 5, pp. xiii. and 310. *Presented by the Publishers.*
An attempt to present the political and historical geography of the British Empire in a picturesque form for the use of schools. The book is intended to supplement rather than to supersede existing text-books, and should be useful for the purpose of interesting scholars in the history of the growth and development of the Empire.

French Colonies. ——
Ministère des Colonies, Office Colonial. Statistiques Coloniales pour l'Année 1899. Commerce. Melun, 1901. Size 9½ × 6, pp. xiv. and 950. *Presented by the French Colonial Office.*

German Colonies. **Fitzner.**
Deutsches Kolonial-Handbuch. Nach amtlichen Quellen bearbeitet von Dr. Rudolf Fitzner. Band I. (pp. viii. and 412); Band II. (pp. iv. and 272). 2, erweiterte Auflage. Berlin: Hermann Paetel, 1901. Size 9 × 6. *Maps.*
In this, the second edition, Dr. Fitzner's valuable work of reference with regard to the German colonies has been much extended, and forms an indispensable compendium of information.

Madrid Geographical Society—Catalogue. **Rózpide.**
B.R.S.G. Madrid (1901): pp. 198.
Repertorio de Publicaciones y Tareas de la Sociedad Geográfica de Madrid (1876–1900). Por Ricardo Beltrán y Rózpide.

NEW MAPS.

By E. A. REEVES, *Map Curator*, R.G.S.

EUROPE.

England and Wales. **Ordnance Survey.**

ORDNANCE SURVEY OF ENGLAND AND WALES:—Revised sheets published by the Director-General of the Ordnance Survey, Southampton, from February 1 to 28, 1902.

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Printed in colours: 162, 1*s.*; 131 and 147 (combined), 1*s.* 6*d.*

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(***E. Stanford, London Agent.***)

England and Wales. **Bartholomew.**

Reduced Ordnance Survey of Windermere and Morecambe bay, coloured, for tourists and cyclists. Scale 1: 63,360 or 1 stat. mile to an inch. Edinburgh: J. Bartholomew & Co., 1902. *Price* 2*s. mounted on cloth. Presented by the Publishers.*

A good map for tourists and cyclists. In style of production, it resembles Bartholomew's 2 miles to the inch maps of England and Wales, showing relief by contour lines and colour tinting. Driving and cycling roads are shown in red, and clearly distinguished from footpaths; railways are indicated in black. Contour lines give the depths of the lakes, evidently from the surveys of Dr. H. R. Mill.

Germany. **Hansen.**

Rüstringen und Wangerland am Jadebusen. Von R. Hansen. Scale 1: 150,000 or 2·4 stat. miles to an inch. *Petermanns Geographische Mitteilungen, Jahrgang,* 1902, Tafel 4. Gotha: Justus Perthes. *Presented by the Publishers.*

Germany. **Krauss.**

Radfahrer-Uebersichtskarte von Deutschland und den benachbarten Ländern, herausgegeben vom Deutschen Radfahrer-Bunde. Bearbeitet von P. Krauss.

Scale 1 : 850,000 or 11·8 stat. miles to an inch. Sheets: 2, 4, 6. Bibliographisches Institut, Leipzig.

With these three sheets this road-map of Germany is complete. Main roads are shown in red, and red figures indicate the distance between the principal towns through which these roads pass.

AFRICA.

Central Africa. **Moisel.**

Dr. F. Stuhlmann's Aufnahmen im Gebiet des Albert- und Albert-Edward-Sees, während der Emin Pascha-Expedition, Mai 1891 bis Januar 1892. Konstruirt und gezeichnet von Max Moisel. Scale 1 : 300,000 or 4·7 stat. miles to an inch. *Mittheilungen der Geogr. Gesellschaft in Hamburg*, xvii., Kartes 1 A and B. Hamburg: L. Friederichsen & Co., 1901. *Two Sheets and Letterpress.*

Although ten years have elapsed since the journey of Dr. A. Stuhlmann was undertaken, and although the narrative of his expedition was published some time ago, yet until this map appeared, the complete and detailed results of his surveys had not been published. Now that our knowledge of the region between Albert Edward Nyanza and Albert Nyanza has been considerably extended by more recent explorations, it has been considered advisable to compile a map of the whole region, combining the surveys of other explorers with those of Dr. Stuhlmann, whose routes extended from the western shores of Albert Edward Nyanza, in a northerly direction, to the country to the north-west of Albert Nyanza, as well as to the Ruwenzori range. The original documents of Dr. Stuhlmann, which have been made use of in the compilation of this map, include, amongst others, route-survey books, seventy-five sheets of profiles and sections, astronomical observations for fixing the latitude and longitude of places and variation of compass, and aneroid observations for altitudes. These have been utilized in the preparation of this map, which has been plotted with great care, in the first place on a large scale, and then reduced. In the letter-press which accompanies the map, Herr Max Moisel gives a list of Dr. Stuhlmann's own documents, and the latitudes and longitudes of places fixed by him, as well as of the maps and observations of other explorers which he has made use of. He gives also his authority in adopting the position of certain places shown upon the map. Although he has not overlooked the surveys of Mr. M. Fergusson, of Mr. Moore's expedition, published in the *Geographical Journal* for June, 1901, it is rather surprising that he has not followed him in the delineation of the northern shore of Albert Edward Nyanza, and there are one or two other points that are perhaps open to criticism. However, this is a most useful map, if only from the fact that we now have Dr. Stuhlmann's survey work of this region published on a scale that is large enough to be serviceable.

Congo Free State. **Langhans.**

Spezialkarte von Marungu und Utembue. Nach neueren Aufnahmen der Weissen Väter (Apostolisches Vikariat der Obern Kongo), entworfen von Paul Langhans. Scale 1 : 300,000 or 4·7 stat. miles to an inch. *Petermanns Geographische Mitteilungen*, Jahrgang 1902, Tafel 2. Gotha: J. Perthes. *Presented by the Publisher.*

Includes the district round Baudouinville, on the western shore of Lake Tanganyika, between 6° 20′ and 7° 40′ S. lat., and 29° 10′ and 30° E. long. Notes on the character of the country are given, and the geology of certain localities indicated by means of colouring. Travellers' routes are also shown.

South Africa. **Favre.**

Carte du Théatre de la Guerre Sud Africaine, par le Col. Camille Favre. Scale 1 : 1,600,000 or 25·3 stat. miles to an inch. Genève: Librairie Georg & Co., 1902. *Presented by the Author.*

This is a general map of the eastern and central part of South Africa, published to illustrate the military operations. The scale is somewhat small, but a good deal of information is given, and the names of places rendered important by recent battles are indicated. It is printed in colours, and contains two insets.

South Africa. **Johnston.**

Special map of South Africa. Scale 1 : 2,661,120 or 42 stat. miles to an inch. Edinburgh and London: W. & A. K. Johnston, 1902. *Price 1s. Presented by the Publishers.*

One of the numerous cheap popular maps of South Africa that have been published lately to illustrate the military operations. The names of important places are underlined in red, and sites of battles are shown. In addition to the principal map there are several insets.

AMERICA.

Nicaragua. **Nicaragua Canal Commission.**

Tiefenkarte des Nicaragua-Sees, nach den Aufnahmen der Nikaraguakanal-Kommission. Scale 1 : 400,000 or 6·3 stat. miles to an inch.—Geologische Profile zwischen dem Karibischen Meer und dem Grossen Ozean längs der Kanallinien. *Petermanns Geographische Mitteilungen*, Jahrgang 1902, Tafel 3. Gotha: Justus Perthes. *Presented by the Publisher.*

South America. **Stübel.**

Geographische Verbreitung der hauptsächlichsten Eruptionszentren und der sie Kennzeichnenden Vulkanberge in Südamerika. Scale 1 : 10,060,000 or 158 stat. miles to an inch. Von A. Stübel. *Petermanns Geographische Mitteilungen*, Jahrgang 1902, Tafel 1. Gotha: Justus Perthes. *Presented by the Publisher.*

Dr. Stübel has shown on this diagram, or sketch-map, which includes the whole of the Andes from Panama to Tierra del Fuego, the position of the principal centres of eruption and volcanoes, which he has arranged into the following general divisions: (A) The Colombia-Equadorian; (B) the Peru-Bolivian; (C) the Central Chilian; and (D) the Patagonian. The first two of these are again subdivided in smaller groups, each of which is encircled by a red line and bears a certain number, as does also each separate volcano. By means of these numbers and an index which is given on the map, the name of several groups and separate volcanoes can readily be found. Those volcanoes which have been in active eruption during the nineteenth century are distinguished by a red mark in the centre, and by having their names printed in a different type in the index. The map accompanies an interesting paper by Dr. A. Stübel in the January number of *Petermanns Mitteilungen* for this year.

United States. **Rand, McNally & Co.**

Indexed County and Township Pocket Maps of Idaho. Scale 1 : 1,647,360 or 26 stat. miles to an inch, and Georgia. Scale 1 : 950,200 or 15 stat. miles to an inch. Chicago and New York: Rand, McNally & Co., 1901. *Price* $0·25 *each. Presented by the Publishers.*

These are new editions of Rand, McNally & Co.'s useful little indexed maps of the United States. They are, however, very rough productions.

PACIFIC OCEAN.

Hawaiian Islands. **Rand, McNally & Co.**

Indexed Pocket Map of the Hawaiian Islands. Scale 1 : 1,330,560 or 21 stat. miles to an inch. Chicago and New York: Rand, McNally & Co. *Presented by the Publishers.*

Drawn on too small a scale for anything but very general purposes; however, it shows steamer routes and distances to various Pacific ports. Many of the names are very indistinct.

GENERAL.

Ancient Geography. **Kiepert.**

Formæ Orbis Antiqui. 36 Karten im Format von 52 : 64 cm. mit kritischem Text und Quellenangabe zu jeder Karte. No. XX. Italiæ Pars Media. Mit 8 Seiten Text. Ergänzt und herausgegeben von Richard Kiepert. Berlin: D. Reimer (Ernst Vohsen), 1902. *Price* 3 *marks.*

Eight maps are now published out of a total number of thirty-six, which this atlas will contain altogether. Those previously issued are No. IX. Asia provincia (citerior); XII. Insulæ maris Ægaei; XV. Græcia septentrionalis; XVII. Illyricum et Thracia; XIX. Italia inferior cum insulis; XXVI. Insulæ Britannicæ; XXVII. Hispania. The map of central Italy, which appears in this part, is on the scale of 1: 800,000, and contains much useful historical information. In addition to the principal map, there are insets, and eight pages of descriptive letterpress. The atlas is now published in separate sheets as they are ready, at three marks each, instead of delaying the publication for several sheets to be ready to make up a part.

World. **Stieler.**

Neue, neunte Lieferungs-Ausgabe von Stielers Hand-Atlas, 100 Karten in Kupferstich. 3 Lieferung. Gotha: Justus Perthes. *Price* 60 *pf.*

This part contains two maps, each of which is quite new. No. 14, Switzerland, is the western sheet of a new two-sheet map which is to embrace the whole of the Alps, drawn on the scale of 1: 925,000, by Messrs. C. Scherrer and H. Habenicht. No. 40 is a map of the Netherlands, Belgium, and Luxemburg, drawn by C. Scherrer, on the scale of 1 : 1,110,000. This latter contains insets, on enlarged scales, of Amsterdam, Brussels, and the coal-mining district of Mons and Charleroi. The natural scales of the maps in this part are certainly remarkable, and it is difficult to see why they have been

selected instead of even multiples of a million. Possibly the size of the sheet has had something to do with the matter, but surely the difficulty could have been obviated, if by no other means, by slightly altering the areas included. However, the maps are both well executed, and will doubtless prove very useful for general reference.

CHARTS.

Danish Chart. **Danish Admiralty.**

No. 147, Grönland med omgivelser. Scale 1 : 1,900,000 or 30 stat. miles to an inch. Sökaart Archiv, Kjöbenhavn, 1902. 2 sheets. *Presented by the Danish Admiralty.*

North Atlantic Ocean and Mediterranean Sea. **Meteorological Office, London.**

Pilot Chart of the North Atlantic and Mediterranean for March, 1902. London: Meteorological Office. *Price 6d. Presented by the Meteorological Office.*

U.S. Charts. **U.S. Hydrographic Office.**

Pilot Charts of the North Atlantic Ocean for February, and North Pacific Ocean for March, 1902. U.S. Hydrographic Office, Washington, D.C. *Presented by the U.S. Hydrographic Office.*

PHOTOGRAPHS.

Alaska and British Columbia. **Cook.**

Nine Photographs of Alaska and British Columbia. By W. H. Cook, Esq. 1898. *Presented by W. H. Cook, Esq.*

Enlarged from snap-shots taken by Mr. W. H. Cook while on a voyage round the world in 1898. The titles are as follows:—

(1) Yakutat, near Mount St. Elias; (2) Dutch harbour; (3–4) Glaciers near Cross sound; (5, 6) Snow-capped mountains near Chatham straits; (7) Bella Bella, Indian playground; (8) Snow-capped mountains near Pitt island; (9) Coast view near Pitt island.

Algerian Sahara. **King.**

Fifty-three Photographs of the Algerian Sahara between Biskra, El Wad, and Wargla. By W. J. Harding King, Esq. *Presented by W. J. Harding King, Esq.*

This is a set of "Kodak" photographs. Most of them are very clear, and, as will be seen from the titles, the subjects are of ethnological and geographical interest.

(1, 2) A Hoggar Tuareg (a noble); (3) Group of Tuaregs; (4) A Tuareg eating dates; (5) Tuareg tent; (6) Tuareg sheikh on camel; (7, 8) Tuareg camp; (9) Cemetery of caravan murdered by Tuaregs; (10) Tent of Tuareg chief; (11) El Wad from minaret of mosque; (12) Palms planted in hollow between dunes, El Wad; (13) The market, El Wad; (14) Among the sand-dunes, near El Wad; (15) Palm groves near El Wad, from minaret of mosque; (16) Tobacco plantation near El Wad; (17) A "guemeerah," artificial land-mark near El Wad; (18) Among the sand-dunes, near El Wad (land-mark in distance); (19) Interior of mosque, Tugurt; (20, 21) The market, Tugurt; (22) Scorpion-proof bedstead, Tugurt; (23, 24) Street in Tugurt; (25) Water-carrier, Tugurt; (26) A Jew of Tugurt; (27) Oyers at work in market, Tugurt; (28) Tombs of the Beni Jellab, old sultans of Tugurt; (29) Well between Tugurt and Wargla; (30) Camel postmen between Tugurt and El Wad; (31) Between Tugurt and El Wad: bushes thrown up by side of road to act as "guemeerahs" (land-marks); (32) One of the gates at Wargla; (33) A "khottara" well near Wargla; (34) Man carrying water in basket of plaited grass, Wargla; (35) Market square, Wargla; (36) Court of a mosque, Wargla; (37) Wargla from a minaret of mosque; (38) Street in Wargla; (39) Interior of native house, Wargla; (40) Courtyard in Zawia monastery of Temalatta; (41) Moat and wall of Temassin; (42) A Ronara girl, inhabitant of Wad Khirh oasis; (43) Cairn marking grave of murdered man; (44) A desert mosque; (45) Stalking gazelle with a camel; (46) Stalking gazelle with a camel: the signal for the camel to turn; (47) Moat and wall of N'goussa; (48) Watch-tower on wall of palm plantation, Filiash oasis, near Biskra; (49) The "bordj," caravanserai, of Setil; (50) The "bordj" of M'raier; (51) Wedding dance at M'raier; (52) Marabut's tomb near M'raier; (53) Market square, M'raier; (54) Ronara woman from M'raier.

Ashanti. **Fergusson.**

Eleven Photographs of Ashanti, by Malcolm Fergusson, Esq. *Presented by Malcolm Fergusson, Esq.*

Taken by Mr. Fergusson during his explorations in the neighbourhood of Lake Busumchwi, described in the *Geographical Journal* for last month:—

(1, 2) Lake Busumchwi; (3) Fisherman, Lake Busumchwi; (4, 5) Boy returning from fishing, Lake Busumchwi; (6) Crossing a creek, Lake Busumchwi; (7) Submerged

trees, showing rapid rise in Lake Busumchwi; (8) Market-place and scaffold, Kumasi; (9, 10) Villages on Kumasi road; (11) Rubber-carriers going to the coast.

Bahamas. **Coonley, Davenport, and Mancel.**

One hundred and nineteen Photographs of the Bahamas, by Messrs. Coonley, Davenport, and Mancel. *Presented by the Colonial Office Library.*

These photographs form a valuable and welcome addition to the Society's collection. They are of different sizes, and vary considerably in merit. A few of them are stereoscopic views. The titles are as follows:—

(1) Central and Western view of Nassau from cathedral tower; (2) Central view of Nassau from the harbour; (3) North-west view of Nassau; (4) North-east view of Nassau from Government House; (5) Nassau harbour from Water battery; (6, 7) Nassau harbour; (8–10) Barracks and harbour; (11) Entrance to harbour, from Government House; (12) Wharves and harbour; (13) Entrance to harbour, Silver cay in distance; (14) Unloading sponges, Nassau; (15) Fishing-boats, Nassau harbour; (16) St. George's Club boats; (17) Barque *Maggie* stranded on Tony rock bar, mouth of Nassau harbour; (18) Fishing-boats undergoing repair; (19) Mail steamer *San Jacinto*; (20–22) Government House, Nassau; (23) Statue of Columbus, Nassau; (24, 25) Military Barracks, Nassau; (26), Town Parade; (27, 28) Officers' quarters; (29) View in Ordnance yard, Nassau; (30) Military hospital, Nassau; (31) Commissary, Nassau; (32) Eastern Parade and Fire Engine Company, Nassau; (33) Residences of attorney-general, bishop, etc.; (34–36) Public buildings, Nassau; (37, 38) Silk-cotton tree near public buildings, Nassau; (39) Silk-cotton tree by police barracks, Nassau; (40) Public Library, Nassau; (41) Robinson Gardens (Library grounds), Nassau; (42) Prison, Nassau; (43) Fort Fincastle and old quarry, Nassau; (44, 45) Queen's staircase near Fort Fincastle, Nassau; (46) Interior of cathedral, George Street, Nassau; (47) Christ Church Cathedral, Nassau; (48) Christ Church rectory, Nassau; (49) St. Matthew's Church, near Nassau; (50, 51) St. Mary's Church, Nassau; (52) Presbyterian Church, Nassau; (53) Methodist Chapel, Nassau; (54) St. Andrew's Hall and Kirk, Nassau; (55, 56) Royal Victoria Hotel, Nassau; (57) Silk-cotton tree in Royal Victoria Hotel grounds, Nassau; (58) Gregory Arch near Government grounds; (59–64) Bay Street, Nassau; (65) Vendue House, Bay Street, Nassau; (66) Cottages in East Bay Street, Nassau; (67) Cocoanut grove; (68) Cumberland Street, Nassau; (69–71) Dowdeswell Street, Nassau; (72, 73) East Street, Nassau; (74–76) George Street, Nassau; (77) Matthew Avenue, Nassau; (78) Shirley Street, Nassau; (79) View from Shirley Street, looking north, Nassau; (80) Union Street, Nassau; (81) Market, Nassau; (82) Tropical types of buildings; (83) Fleming Square, Nassau; (84) Centreville; (85) View on Sandilands road; (86) School at Sandilands; (87) Asylum, New Providence islands; (88) Lepers' ward, New Providence Asylum; (89) "The Hermitage;" (90) Cunningham lake; (91) Negro hut; (92) Rural scene; (93) Banyan tree; (94) Salt bay; (95) Alley in Grant's Town; (96) Grant's Town cottage; (97) Negro group, Grant's Town; (98) View of Port Howe, Cat island; (99) Festival scene, August 1, Eleuthera; (100) View at Spanish wells, Eleuthera; (101) The Cove settlement, Eleuthera; (102) St. John's Church, Harbour island; (103) Wesleyan Chapel, Harbour island; (104) Views from wharf, looking west, Harbour island; (105) View from the Mission House, looking south-west, Harbour island; (106) View from the school house, Harbour island; (107) Bay Street, looking east, Harbour island; (108) Howelton, Hog island; (109, 110) Hog island lighthouse; (111, 112) Gregory Street, Inagua; (113, 114) View at Inagua; (115) Kortwright Street, Inagua; (116) Shipping salt, Inagua.

Bulgaria. **Buxton.**

Twenty-two Photographs of Bulgaria. By Noel Edward Buxton, Esq. *Presented by Noel Edward Buxton, Esq.*

The greater number of these photographs illustrate the dwellings and life of the inhabitants. The following is a list of the titles:—

(1) Petha Karaveloff (prime minister of Bulgaria) and his family; (2) Entrance to Rilo; (3–8) Rilo monastery; (9) Hermit's chapel at Rilo; (10) Frescoes at Rilo chapel; (11, 12) Peasants at Trojan fair; (13) Wool fair at Trojan; (14, 15) Monastery of Trojan; (16, 17) Peasants at Tirnova; (18) Protestant school at Samakov; (19) School-children from Samakov, at Chamkouria; (20) School-children at Chamkouria; (21) Rushchuk from the Danube; (22) A team of bullocks resting at midday.

England—River Trent. **Weller.**

Six Photographs of the "Aegir" on the Trent at Gainsborough. By C. L. Weller, Esq. 1901. *Presented by C. L. Weller, Esq.*

An interesting set of photographs illustrating the bore, or "aegir," as it is called, of the Trent.

(1) Wave coming up-stream; (2) Wave breaking over a shallow; (3) Wave dashing against the bridge; (4) Wave passing the bridge; (5) The "whelps," or small waves that follow the "aegir;" (6) Boats among the "whelps."

Hong-Kong. **Hurley.**

Sixty Photographs of Hong-Kong. By H. C. Hurley, Esq., 1897. *Presented by the Colonial Office Library.*

An album of photographs published in Hong-Kong in 1897 to celebrate the Diamond Jubilee of her late Majesty Queen Victoria. Their titles are as follows:

(1) The island in 1837; (2) Possession point, British flag hoisted Jan. 25, 1841; (3) Murray battery, erected to cover the city, 1845; (4) Hong-Kong, 1897; (5) The city of Victoria, 1897; (6) Government house; (7) Headquarters house; (8) St. John's Cathedral; (9) The Roman Catholic Cathedral (Church of the Immaculate Conception); (10) The City Hall; (11) Fountain erected by John Dent, Esq.; (12) Hong-Kong and Shanghai bank; (13) Government civil hospital; (14) St. Paul's College; (15) The Berlin foundling house; (16) Queen's College; (17) Belilios public school; (18) Government offices; (19) The Hong-Kong club; (20) The central market; (21) Market boats; (22) The Praya reclamation; (23) Cargo boats; (24) The public gardens, from the east; (25) The public gardens, from the west; (26) The Queen's Jubilee statue; (27) Sir Arthur Kennedy's statue; (28) The Peak tramway; (29) Mount Gough (1200 feet); (30) Mount Austin Hotel (1400 feet); (31) Mount Kellet (1500 feet); (32) Victoria peak and signal station (1825 feet); (33) Magazine gap (1000 feet); (34) Pokfolum reservoir; (35) Tytam reservoir; (36) The harbour and Kaulun peninsula from the peak; (37) The man-of-war anchorage; (38) Kaulun, looking east; (39) Kaulun, looking west; (40) The Hong-Kong and Whampoa Dock Co.'s premises; (41) The Kaulun Wharf and Godown Co.'s premises; (42) The East Point sugar-refinery; (43) The Quarry Bay sugar-refinery; (44) The Wong-Nei-Cheong valley and race course; (45) The grand stand; (46) The Mun-Mo temple (decorated); (47) The reception hall, Tung Wah hospital (48); Native Jubilee decorations; (49) Native flower show pavilion; (50, 51) Queen's road, Central; (52) Procession to the thanksgiving service; (53) Laying the foundation-stone of the new hospital; (54) The review, grand stand, Happy valley; (65) The review, native ladies' pavilion, Happy valley; (56) The Royal Engineers, Wellington Barracks; (57) The Hong-Kong volunteers' headquarters; (56) Review of the troops, Happy valley; (59) His Excellency Sir William Robinson, G.C.M.G., and members of the Legislative Council; (60) Gap Rock lighthouse.

Morocco. **Fawcett.**

Forty Photographs of Morocco. By Captain P. H. Fawcett, R.G.A. 1901. *Presented by Captain P. H. Fawcett, R.G.A.*

Captain Fawcett's journey during which these photographs were taken was described in the *Geographical Journal* for February last. Although small in size, most of the subjects are very interesting. They are as follows:

(1, 2) Water-gate, Mogador; (3) Outside the gate, Mogador; (4) Gate, Mogador; (5) Street, Mogador; (6) Grain market, Mogador; (7) Prison, Mogador: prisoners scrambling for ½ pesetas; (8) Start of the journey from Mogador; (9) Zalat Harata; (10) Ulad Ben Oasmein, looking about north-west; (11) Ruins of Kasba Lassenah at Ulad Ben Oasmein; (12, 13) Spring, Tirbzan; (14, 15) Jews at Mella Sheshawa; (16) Camp at Mella Sheshawa; (17) Jewish girls at Sheshawa; (18) Crossing Wadi N'Fiss at Sheshawa; (19) Aitimur; (20) Street, Tameslaht; (21) Olive gardens at Tameslaht; (22) On the plain of Morocco between Tameslaht and Morocco city; (23) Plain of Morocco, looking south to the Atlas range, from just outside the town walls; (24) Morocco city from the south-west; (25) Market at Morocco city; (26, 27) Street, Morocco city; (28) Kotubieh tower, Morocco city; (29) Camp of Sultan's body-guard at Morocco city; (30) Looking over plain of Morocco towards Morocco city from Jebelet hills; (31) On the summit of Jebelet, looking over plain of Morocco towards Morocco city; (32) Part of Morocco city with Atlas mountains in background; (33) Nzela Menebha, looking south towards the Jebelet hills; (34) Looking out of tent, Nzela Menebha over Rahamna plain to north; (35) Gurrundu, looking east; (36) Entrance to subterranean dwellings, Gurrundu; (37) Well, over 300 feet deep, at Ulad Waziz; (38) Mazaghan from the south-east; (39) Casa Blanca from the land side; (40) Street, Casa Blanca.

N.B.—It would greatly add to the value of the collection of Photographs which has been established in the Map Room, if all the Fellows of the Society who have taken photographs during their travels, would forward copies of them to the Map Curator, by whom they will be acknowledged. Should the donor have purchased the photographs, it will be useful for reference if the name of the photographer and his address are given.